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VOL. XXV JANUARY to DECEMBER, 1920

JOURNAL
OF THE
WESTERN SOCIETY
OF
ENGINEERS

PAPERS, DISCUSSIONS, ABSTRACTS
PROCEEDINGS

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CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV JANUARY 5, 1920 Number 1

PUBLIC WORKS NATIONAL CONVENTION

W. S. E. Will Have A Representative at Washington

The National Public Works Department Association convention will be held in Washington, January 13 and 14, under the Direction of Engineering Council.

W. L. Abbott will be the representative of the Western Society of Engineers, selected by the Board of Directors to attend this conference.

This will be the largest representative gathering of engineers, architects and constructors ever held by them in the interests of the government.

It was first planned to have the convention last three days but later it was decided to shorten the program.

Meetings of the conference are to be held in the ball room of the Hotel Willard. Voting at the sessions will will be done by voice or division of delegates present, unless otherwise directed by the convention. On demand of five delegates the vote on any question will be taken by roll call of organizations represented, each to be recorded according to the number of members registered at presentation of credentials.

After the business meeting on Tuesday morning, January 13, a communication from Frank O. Lowden, governor of Illinois, will be read. His paper will outline the accom-

(*Continued on page* 23)

WASHINGTON AWARD TO HERBERT HOOVER

Will Be Guest of Society in February

Herbert Hoover, so well known to all engineers, has been named as the first recipient of the Washington Award.

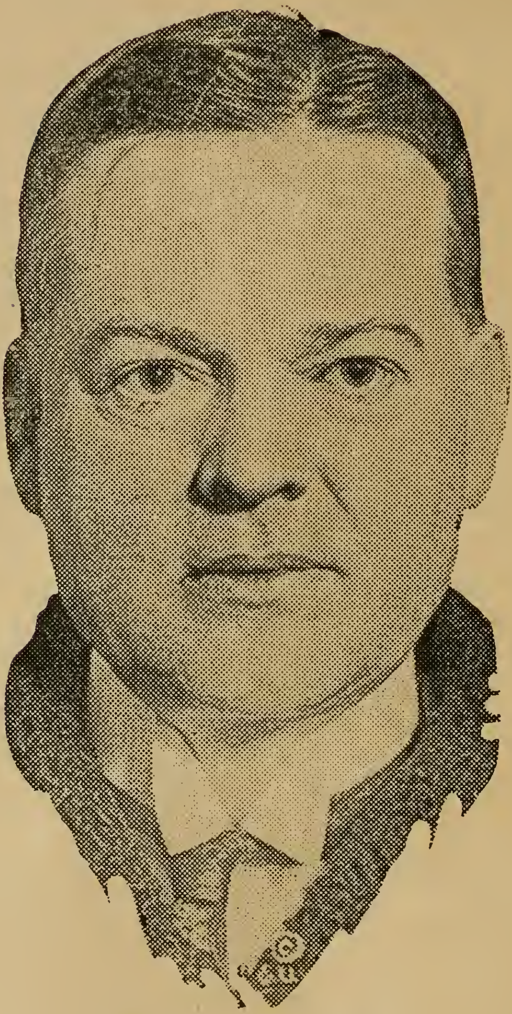
He will come to Chicago as the guest of the Western Society the latter part of February to receive the award. Because of his absence from the United States, a convenient time to present the award has not been named until now.

Recently passing through Chicago on his way to California, Mr. Hoover met in conference with C. F. Loweth and the Secretary and promised to address the Society.

The Western Society will announce the exact date and arrange for a meeting at which it is confidently expected that we will have a larger gathering of our members than that of December 2. The four Founder Societies act with the Western Society in determining the recipient of the award and members of their local sections will be in attendance also.

ON INDUSTRIAL COMMISSION

In addition to the many conspicuous services which Mr. Hoover has performed during the late war and the period immediately following it, he is now serving as vice chairman of the Industrial Commission ap-



HERBERT CLARK HOOVER

pointed by President Wilson. He was appointed to the commission as a representative of the engineering profession.

The commission, Mr. Hoover pointed out while in Chicago, desires the intelligent discussion of its findings. While labor and capital will undoubtedly take opposing viewpoints, the public will, as it is organized at present, be the humble third party which will bear the brunt of their agreements and disagreements. Both capital and labor are well organized and can present their views emphatically and concisely.

Leaders of the public mind must be found, he said, and it is not unlikely that the professional man will thus find an opportunity to voice the views of the public.

In view of that fact, is this not the time for professional technical societies, engineers, architects and chemists to assume the leadership?

It is safe to say that Mr. Hoover will be the next President of the American Institute of Mining and Metallurgical Engineers. He is an engineer and a thorough supporter of technical societies.

Commission's Report Announced

The industrial commission's tentative report was handed President Wilson December 22. It was made public December 29. A plan of settlement of disputes in industry is outlined.

The report, consisting of a 4,000 word statement, is for the consideration of capital, labor and the public. The conference will reconvene January 12 for the purpose of hearing any criticisms that may be offered and then will draft its final recommendations to the president. Charles Piez will discuss the report at the January 5 meeting of the Society.

This first report recommends that:

1. The president shall appoint a national industrial tribunal which shall serve as a board of appeal in the settlement and adjustment of wage and other disputes.

2. Twelve regional chairmen, also appointed by President Wilson, will be empowered to form boards on occasion from panels of employers and employees for the adjustment of particular controversies.

3. When either or both parties refuse to abide by the decisions of a board of adjustment, a regional board of inquiry shall investigate and report on the case.

4. Boards may refer a dispute to umpires for decision.

Railroads and Public Utilities

The conference declined to offer a solution of the strike problem as it affects railroad and public utility employees, saying on that particular point that government regulation and the danger of interrupting service made it impossible to submit concrete proposals at present.

Mr. Hoover while here intimated that he would present to the Western Society in February the final recommendations of the commission. No matter what recommendations the report may contain it must be either rejected or accepted by capital, labor and the public.

Engineer Must Act

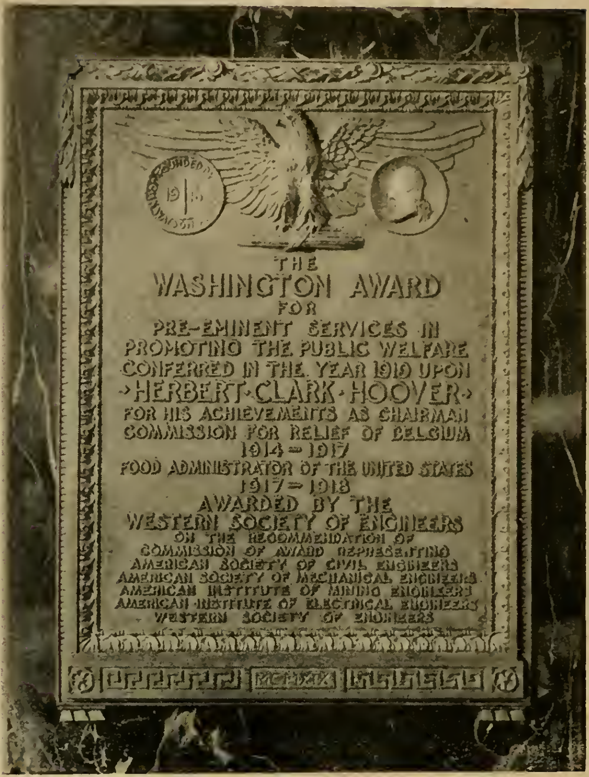
Whether or not the engineer and the technical man has ever had any direct relation to either capital or labor, his powers of analysis and the ability to consider a problem from all angles place him in a position where an unbiased opinion as to the justice and scope of the recommendations can be rendered.

The Journal of the Western Society of Engineers urges upon the members of the Society to act collectively or individually in expressing your opinions of the final report of the industrial commission.

Surely this is a time when decisive, concrete action is needed. Who knows. **The technical profession may be destined to play the part of Moses to the public.**

Officers of the Illinois Chapter, American Society of Heating and Ventilating Engineers for the 1919-1920 season are:

President, John Howatt.
Vice President, J. C. Horung.
Treasurer, August Kehm.
Secretary, Benjamin Nelson.
Board of Governors: G. W. Hubbard, C. W. Johnson, F. W. Lamb.


THE
WASHINGTON AWARD
FOR
PRE-EMINENT SERVICES IN
PROMOTING THE PUBLIC WELFARE
CONFERRED IN THE YEAR 1919 UPON
HERBERT CLARK HOOVER
FOR HIS ACHIEVEMENTS AS CHAIRMAN
COMMISSION FOR RELIEF OF BELGIUM
1914 = 1917
FOOD ADMINISTRATOR OF THE UNITED STATES
1917 = 1918
AWARDED BY THE
WESTERN SOCIETY OF ENGINEERS
ON THE RECOMMENDATION OF
COMMISSION OF AWARD REPRESENTING
AMERICAN SOCIETY OF CIVIL ENGINEERS
AMERICAN SOCIETY OF MECHANICAL ENGINEERS
AMERICAN INSTITUTE OF MINING ENGINEERS
AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS
WESTERN SOCIETY OF ENGINEERS

WASHINGTON AWARD
Founded by John W. Alvord, M. W. S. E.

INDUSTRIAL ENGINEERS' CONVENTION

It has been recently announced that the Society of Industrial Engineers will hold its next convention in Philadelphia, March 24, 25 and 26.

The main subject to be discussed at the program of the convention is "The Practical Application of the Principles of Industrial Engineering." Educational propaganda, embracing industrial engineering and management in its broadest sense will be discussed.

An exhibition will be held in connection with the convention in which furniture appliances designed to eliminate waste motion in business establishments, and a display of instruction books, production charts and employment department forms will be available for examination by the attending delegates.

The last meeting of the Chicago Chapter of the Society was held December 11. Ralph D. Heilman, Dean of the Northwestern University School of Commerce, delivered an address on "Profit Sharing."

PRELIMINARY REPORT OF INDUSTRIAL COMMISSION

Plan for Board of Inquiry and Adjustment

NATIONAL TRIBUNAL AND REGIONAL BOARDS

There shall be established a National Industrial Tribunal and Regional Boards of Inquiry and Adjustment.

NATIONAL INDUSTRIAL TRIBUNAL

The National Industrial Tribunal shall have its headquarters in Washington, and shall be composed of nine members chosen by the President and confirmed by the senate. Three shall represent the employers of the country and shall be appointed upon nomination of the Secretary of Commerce. Three shall represent employees and shall be appointed upon nomination of the Secretary of Labor. Three shall be representatives of the public interest. Not more than five of the members shall be of the same political party.

The tribunal shall be, in general, a board of appeal. Its determinations on disputes coming to it upon an appeal shall be by unanimous vote. In case it is unable to reach a determination, it shall make and publish majority and minority reports which shall be matters of public record.

INDUSTRIAL REGIONS

The United States shall be divided into a specified number of industrial regions. The conference suggests 12 regions with boundaries similar to those established under the Federal Reserve system, with such modifications as the industrial situation may make desirable.

REGIONAL CHAIRMEN AND VICE CHAIRMEN

In each region the President shall appoint a regional chairman. He shall be a representative of the public interest, shall be appointed for a term of three years and be eligible for reappointment.

Whenever in any industrial region, because of the multiplicity of disputes, prompt action by the Regional Board is impossible, or where the situation makes it desirable, the National Industrial Tribunal may in its discretion choose one or more vice chairmen and provide for the establishment under their chairmanship of additional regional boards.

PANELS OF EMPLOYERS AND EMPLOYEES FOR REGIONAL BOARDS

Panels of employers and employees for each region shall be prepared by the Secretary of Commerce and the Secretary of Labor, respectively, after conference with the employers and employees, of the regions. The panels shall be approved by the President.

At least 20 days before their submission to the President provisional lists for the panels in each region shall be published in such region.

The panels of employers shall be classified by industries; the panels of employees shall be classified by industries and sub-classified by crafts. The names of employers and employees shall be at first entered on their respective panels in order determined by lot.

The selection from the panels for service on the Regional Boards shall be made in rotation by the regional chairman; after service the name of the one so chosen shall be transferred to the foot of the panel.

REGIONAL BOARDS OF ADJUSTMENT

Whenever a dispute arises in a plant or group of plants which is not settled by agreement of the parties or by existing machinery, the chairman may, on his motion, unless disapproved by the National Industrial Tribunal, and shall at the request of of the Secretary of Commerce or the Secretary of Labor or the National Industrial Tribunal, request each side concerned in such dispute to submit it for adjustment to a Regional Board of Adjustment. To this end each side shall, if willing to make such submission, select within not less than two nor more than seven days, at the discretion of the chairman, a representative. Such selection shall be made in accordance with the rules and regulations to be laid down by the National Industrial Tribunal for the purpose of insuring free and prompt choice of the representatives.

The appointment of representatives of both sides shall constitute an agreement to submit the issue for adjustment and further shall constitute an agreement by both sides that they will continue, or re-establish and continue, the status that existed at the time the dispute arose.

Regional Boards of Inquiry

If either side to the dispute fails, within the period fixed by the chairman, to select its representatives, the chairman shall proceed to organize a Regional Board of Inquiry. Such Regional Board of Inquiry shall consist of the regional chairman, two employers, selected in the manner specified from the employers' panel, and two employees selected in a like manner from the employees' panel and the representatives of either side that may have selected a representative and agreed to submit the dispute to the Board. If neither side shall select a representative within the time fixed by the chairman, the Board of Inquiry shall consist of the chairman and the four panel members only.

The Board of Inquiry as so constituted shall proceed to investigate the dispute and make and publish a report, or majority and minority reports, of the conclusions reached, within five days after the close of its hearings, and within not more than 30 days from date of issue of the original request by the chairman to the two sides to dispute, unless extended on unanimous request of the board or the National Industrial Tribunal. It shall transmit copies of this report or reports to the Secretaries of Commerce and of Labor, respectively, and to the Natioal Industrial Tribunal, where they shall be matters of public record.

Umpires

When a regional Board of Adjustment is unable to reach a unanimous determination, it may by unanimous vote select an umpire and refer the dispute to him with the provision that his determination shall be final and shall have the same force and effect as a unanimous determination of such regional board.

Effect of Decisions

Whenever an agreement is reached by the parties to a dispute or a determination is announced by a Regional Board of Adjustment, or by an umpire, or by the National Industrial Tribunal, the agreement or the determination shall have the full force and effect of a trade agreement which the parties to the dispute are bound to carry out.

General Provisions

In connection with their tasks of inquiry and adjustment, the Regional Board and the National Tribunal shall have the right to subpoena witnesses to examine them under oath, to inquire the production of books and papers pertinent to the inquiry, and their assistance in all proper ways to enable the board to ascertain the facts in reference to the causes of the dispute and the basis of a fair adjustment. Provisions shall be made by law for the protection of witnesses and to prevent the misuse of any information so obtained. In the presentation of evidence to the Tribunal and the Boards each side shall have the right to present its position through representatives of its own choosing.

Special Provisions

The terms of office of members of the National Industrial Board shall be six years; at the outset three members, including one from each group, shall be appointed for a term of two years, three members for a term of four years, and three members for a term of six years; thereafter three members, one from each group, shall retire at the end of each period of two years.

Relation of Board to Existing Machinery for Conciliation and Adjustment

The establishment of the National Industrial Tribunal and the Regional Boards described shall not affect existing machinery of conciliation, adjustment, and arbitration established under the federal government, under the governments of the several states and territories, or subdivisions thereof, or under mutual agreements of employers and employees.

STATEMENT AS TO PUBLIC UTILITY INDUSTRIES

The conference believes that a plan of tribunals or boards of adjustment and inquiry should be applied to public utilities, but in the adaptation of the plan, two problems present themselves. First, governmental regulation of public utilities is now usually confined to rates and services. The conference considers that there must be some merging of responsibilities before regulation of rates and services and the settlement of wages and conditions of labor. Such co-ordination will give greater security to the public, to employee, and to employer. Second, is the problem whether some method can be arrived at that will avert all danger of interruption to service. These matters require a thorough consideration before concrete proposals are put forward.

STATEMENT AS TO GOVERNMENT EMPLOYEES

The right of government employees to associate for mutual protection, the advancement of their interests or the presentation of grievances cannot be denied, but no such employees who are connected with the administration of justice or the maintenance of public safety or public order should be permitted to join or retain membership in any organization which authorizes the use of the stripe or which is affiliated with any organization which authorizes the strike.

FURTHER WORK OF THE CONFERENCE

On reconvening the Conference will continue its consideration of tribunals for the furtherance of industrial peace in general industry in the light of whatever criticism and suggestions the publication of its tentative plan may call forth. It will receive reports of investigations that are being made for it. On the basis of such reports and the further study of these and the other subjects within its field, the conference hopes that it may be able to contribute something more toward the better industrial relations described in words addressed to it by the president when he called it into being—relations in which "the workman will feel himself induced to put forth greater effort."

January 5, 1920.

MOBILIZATION

The success of the Western Society of Engineers is dependent on its members. The constructive work of the Society is carried on largely by committees.

In order that these committees may do their work well, they should be made up of men specially selected for the work. Committees for this year will be chosen during February and suggestions as to the composition of these units are in order. Who do you think would be a good man on the Finance Committee, Library Committee, Program, Publication, Amendments and Membership Committees? These are the standing committees. Then there are special committees such as those on Public Affairs, Development, Legislation, Entertainment, Young Men and others. To these it might be well to urge the formation of committees on Industrial Relations, Technical Education, Student Relations and City Zoning.

The Board of Direction will be materially assisted in its work if you will regard this selection of committees as a personal matter. It is requested that you make known your desire to serve on one committee and also make selections from our membership, of men who are fitted for appointment to certain committees.

While all may not be able to take part in this work, yet members of these various committees should be so chosen as to be representative of the entire society. Ten per cent of our members should serve in committee work and no one person should be on more than one committee.

Charles Keith Blackwood, for seventeen years with the Sullivan Machinery Company, died December 14. At the time of his death he was vice president, assistant treasurer and a director of the company. Mr. Blackwood possessed sound judgment and executive ability and his death is a loss to his many friends and associates.

JOURNAL
OF THE
WESTERN SOCIETY
OF
ENGINEERS

"To promote and advance the science and art of engineering."

COMING !

Prof. Duff A. Abrams, Lewis Institute, will deliver a paper on "Concrete Specifications" before the Bridge and Structural Section of the Society, Monday, January 12. Prof. Abrams was to have appeared before this section December 8, but the confusion caused by the coal shortage forced the postponement of this meeting. The paper will be illustrated by slides.

THE OFFICIAL PUBLICATION OF THE WESTERN SOCIETY OF ENGINEERS

There are two reasons for an official publication of this society. (1) To record the technical transactions of the society. (2) To provide a medium of live contact between the society and its members. The first purpose is fulfilled by the Journal which should contain the papers and discussions presented at the regular and section meetings, and the report of such portions of the annual meetings as warrant a permanent record. The second purpose is obtained through the Bulletin which reports facts of contemporaneous rather than permanent value.

There is every reason for maintaining the Journal in substantially its present form. The makeup and typography are in keeping with its purpose and conform to present standards. Moreover the fact that the Journal is a publication of years standing is a good reason why no change should be made. It has been suggested that the rule followed in the past, namely, to publish the discussion of a paper immediately following and in the same issue with the paper itself be subject to exception. There are two reasons why this should be done. (1) To permit the publication of papers in advance of presentation. (2) To allow more latitude in the size and makeup of individual issues.

The object of the Bulletin as stated above is for the publication of society news. Under this head may be included a chronicle of society doings, advance notice of society affairs, doings of members, local engineering news, matters of public relation. In general, the rule to apply in considering the applicability of any particular item of news would be that it must possess interest to the members through some relation to the society.

Studies of the revenue and expenses of the society's publication indicate that the most practicable arrangement is to publish the Journal and Bulletin together as one publication issued semi-monthly or biweekly. Considerations governing the makeup and arrangement of this publication include the following: (1) The Journal must be published in substantially its present form and in such shape that it may be readily separated from the rest of the material for binding. (2) The Bulletin must be given a form and be placed in a position that render it readily accessible. (3) The advertising must be placed in a position where it will be seen and read by the largest portion of those receiving the paper. (4) Provision must be made for a table of contents and a list of society officers together with the name plate and other information required by postoffice regulations.

PUBLIC WORKS CONVENTION

(*Continued from page* 15)

plishments of the department of public works in this state.

At the evening session, Hon. Frank C. Reavis, House of Representatives, will address the conference on the "Practical Results to be achieved by a State Department of Public Works." Gen. R. C. Marshall, Chief of Construction Division, U. S. A., will address the same meeting on "Practical Economies secured by Standardization of Construction Activities."

Wednesday morning representatives, grouped by states, will confer with members of Congress regarding plans for the establishment of Public Works Departments in all states. The reports of these teams are to be given at the final session, Wednesday afternoon. Discussion of the scope of the work to be undertaken by the conference will occupy the remaining time.

The executive committee in charge of arrangements for the conference is composed of:

M. O. Leighton, chairman, M. E. Ailes, treasurer, C. T. Chenery, secretary, Francis Blossom, Charles B. Burdick, J. Parke Channing, Frederick K. Copeland, D A. Garber, C. E. Grunsky, W. H. Hoyt, Col. Peter Junkersfeld, Charles F. Loweth, Philip N. Moore, Frederick H. Newell, E. J. Russel, Charles Whiting Baker and Robert Spur Weston.

SPECIAL NOTICE

One of the acts of the 38th General Assembly of the State of Iowa was to regulate the licensing of engineers and land surveyors. All engineers who are qualified for registration without examination must make application before January 4, 1920. After that date registration will require the passing of a technical examination before a board.

After July fourth this year, the practice of professional engineering or land surveying without a license will be punishable by a fine of not less than $100.00 and not more than $500.00. The secretary of the Board of Examiners is K. C. Kastberg, Box 923, Des Moines.

January 5, 1920.

WHAT DO YOU THINK OF THIS?

The greatest function of a technical society is the advancement of the science and art of Engineering.

Meetings of the organization, where a prominent speaker draws a large group, helps to serve this purpose. These have been very successful, should be continued and improved.

Technical advancement is composed of details and among our membership there are men interested in like details.

Considering the technical society as a post-graduate privilege, should we not have round table discussions by small groups on the elementary features of our profession?

The facilities are here for our use.

What is your problem?

Who are the men with similar problems?

Why not get them together?

APPLICATIONS FOR MEMBERSHIP AND FOR TRANSFER

The following applications have been received. The members of the society are requested to give information regarding the professional record of these applicants.

Presented to the Board of Direction, December 8, 1919.

674	A. E. Fisk, Chicago.
683	T. F. Leeman, Chicago.
1219	Hudson D. Henion, Chicago.
1222	F. S. Salchenberger, Chicago.
1440	E. C. Kingston, Chicago.
1825	Wallace A. Robinson, Chicago.
1841	A. G. Gould, Davenport, Ia.
1848	Jos. A. Maxwell, Chicago.
1893	Arthur A. Raymond, Chicago.
1912	F. W. Field, Chicago.
1936	Fred N. Bradley, Chicago.
1979	Hugh C. Bersie, Wilmette, Ill.
1995	Claude E. Fitch, Wilmette, Ill.
2010	Harry J. Burke, Chicago.
1220	Frank P. Perkins, Park Ridge.
2029	Ernst J. Stromback, Chicago.
2039	Alfred Luebeck, Chicago.
2040	Samuel Lilienthal, Chicago.
2041	Arthur Sullivan, Chicago.
2042	Fred G. Tebo, Chicago.
2043	Edward A. Jones, Chicago.
2044	Henry W. Watts, Chicago.
2045	Kristian Borge, Chicago.
2046	Bernard Phillips, Chicago.

2047 H. G. Herbert, Chicago.
2048 Albert E. Bredlau, Chicago.
2049 Frank E. Bard, Chicago.
2050 F. E. Rolde, Chicago.
2051 W. J. Wetzel, Chicago.
2052 John Zielas, Chicago.
2053 Morris Grodsky, Chicago.
2054 John C. Parks, Chicago.
2055 Hugh L. Lucas, Chicago.
2056 Wm. B. Weldon, Chicago.
2057 Ervin Edelstein, Chicago.
2058 Thomas F. Wolf, Chicago.
2059 Justus B. Eddy, Chicago.
2060 Roy S. Spalding, Chicago.
2061 Joseph M. Bush, Chicago.
2062 Walter H. Klinsick, Chicago.
2063 Victor A. Mattison, Washington, D. C.
2064 Frank W. Thomas, Chicago.
2065 James B. McIntyre, Chicago.
2066 J. W. Farrish, Chicago.
2067 Frank M. Townsend, Laramie, Wyoming.
2068 Philip Steel, Chicago.
2069 Jas. W. Beatty, Chicago.
2070 Thomas Kavanaugh, Chicago.
2071 Fred D. Parkers, Chicago.
2072 Orvin T. Allen, Chicago.
2073 Arthur Tappan North, Chicago.
2074 George W. Lochow, Chicago.
2075 Robert J. Graham, Chicago.
2076 Samuel Isaacson, Chicago.
2077 Geo. C. Kunbera, Chicago.
2078 Sidney Joseph Burke, Chicago.
2079 Edwin W. Goetz, Chicago.

For Transfer

1415 Clarence S. Roe (from Junior), Lansing, Mich.
1827 Maxwell C. Tobias (from Associate), Chicago.

Presented to the Board of Direction, December 22, 1919:

1705 W. G. Rudd, Chicago.
1832 Oscar H. Fairchild, Chicago.
1835 Royal Herbert Holbrook, Cedar Rapids, Ia.
1887 Henry E. Balsley, Chicago.
1891 Myron B. Reynolds, Chicago.
1896 Robert H. Ford, Chicago.
1937 E. C. Welborn, Evanston, Ill.
2081 James S. Harvey, Jr., Chicago.
2082 Walter E. LaParle, Chicago.
1897 Clifford A. Ashley, Aurora, Ill.

For Transfer

1052 C. B. Nolte (from Junior), Chicago.
1734 Benjamin Shapiro (from Associate), Chicago.
1894 J. O. Kilman (from Associate), Chicago.

Edgar S. Nethercut, *Secretary*.

CLASSIFICATION AND COMPENSATION OF GOVERNMENT ENGINEERS

The Committee on Classification and Compensation of Engineers, Engineering Council, has published the preliminary report of the federal government section of the committee.

The report is much too elaborate to include in the Journal. An outline of it would not serve its purpose. Needless to say, this report is well worth the consideration of the engineering profession because the right solution of the problem of classification and compensation for services is essential to the welfare of the profession and necessary in keeping its standards on a high plane.

This report may be had by applying to the Washington Academy of Sciences, Washington, D. C., or Engineering Council, New York City.

Members of the government section of the committee are: John C. Hoyt, chairman, John S. Conway and O. C. Merrill.

AMERICAN CHEMICAL SOCIETY

Chicago Officers

Chairman, L. V. Redman.
First Vice Chairman, Ethel M. Terry.
Second Vice Chairman, J. A. Hynes.
Secretary, R. J. Quinn.
Treasurer, W. H. Irwin.

Councillors

T. J. Bryan
R. E. Doolittle
H. N. McCoy
W. D. Richardson
W. R. Smith
A. M. Taylor
F. W. Willard
Julius Stieglitz

The officers of the American Railway Engineering Association are:

President, Earl Stimson.
First Vice President, H. R. Safford.
Second Vice President, J. A. Atwood.
Past President, W. B. Storey.
Past President, Robert Trimble.
Past President, A. S. Baldwin.
Past President, John G. Sullivan.
Past President, C. A. Morse.
Treasurer, G. H. Bremner.
Secretary, E. H. Fritch.

January 5, 1920.

ENGINEERS AND INVESTMENT SECURITIES

The important relation of engineering to safe investments and the advisability of engaging consulting engineers to review plans for large projects were two points made in an address to the National Drainage Congress by Edward Bower, representing a firm which handles investment securities. He stated that when such a firm is considering the handling of bonds of a drainage district the engineer's opinion is of equal importance with the lawyer's opinion and that unless the firm can rely upon the reports of the engineers it cannot afford to handle the securities. The engineering work must not only provide for adequate drainage of the district itself but must include consideration of adjacent territory in order that the specific drainage system may not become inadequate at some future time due to water delivered to it from adjoining districts.

In this connection he outlined the proper function of the consulting engineer, as distinguished from what may be called the practicing engineer. To quote Mr. Bower: "It is essential not only that the officers of the district shall employ reputable and competent engineers to create the drainage system itself, but that they shall employ also consulting engineers to act as an effectual check upon those actually doing the work. In any undertaking there is the possibility that those close up, because of their nearness to the thing, may overlook some very essential factors which will be apparent to those who are more remote and for this reason may have a more general view of the situation. Further, this practice has a strong tendency to instill confidence in the minds of purchasers of drainage securities."

One would hesitate to endorse without qualification Mr. Bower's point of view of the need always of employing consulting engineers. It is conceivable that those called in on large projects will have the ability to survey the situation broadly as well as to work out the details. But as to the majority of projects Mr. Bower is right. Those employed are likely to have relatively limited experience, and in such cases broader surveys by a consultant, both before and after the details are worked out should be sound investments.—*Reprinted from "Engineering News-Record."*

NOMINATIONS

Nomination of officers for the coming year was the regular order of business of the hydraulic, sanitary and municipal section at its meeting December 22. The following nominations were received:

Chairman, Wm. Artingstall;
Vice-Chairman, L. R. Howson;
Director, 3 years, A. J. Schafmayer.

Walter Buehler presented an interesting paper on "Wood Block Paving."

The "Jones-Reavis" Bill, authorizing the creation of a National Department of Public Works has been held up in Congress so that the campaign for its passage may be prosecuted, the Engineering Council recently announced.

It is interesting to note the work which Engineering Council has done or is contemplating along welfare lines.

This includes:

Registration of 5,000 returned soldier engineers and placing the great majority of them in positions at a cost of approximately three dollars per man registered;

Aided in the examination of suggestions and inventions for war devices;

Opposed "Anti-Efficiency" proposals in bills before congress;

Is advocating establishment of a National Department of Public Works, embodied in the "Jones-Reavis" Bill;

Organized a committee on types of government contracts;

Assisted State of New York in preparing a plan for reorganization of state government;

On request, sent to house of representatives delegates to testify on a national budget.

WHAT WAS ACCOMPLISHED ALONG RAILWAY ENGINEERING LINES LAST YEAR?

In reviewing the electric railway engineering problems that have been actively discussed during the past year, it is reassuring to find that splendid work is being done to bring about much needed economies. In all of the departments into which we commonly divide such activities, the one outstanding feature is the desire to increase efficiency and so to effect substantial savings * * *

At the Atlantic City Convention the power generation committee of the American Electric Railway Engineering Association presented a notable report on the automatic substation and the form of power contract for electric railways, relating respectively to economical use and purchase of power. The exetnt to which the industry is dependent upon labor has been forcibly brought home in a number of instances and an extension of the use of automatic substations has helped to relieve this condition and at the same time has shown results in reducing costs that are a real encouragement in these times. The trials and troubles experienced with automatic apparatus have not been many and progress in overcoming them has been rapid. Another economy in power generation that has been referred to frequently is the use of special fuels for power plants. * * * If fuels cheaper than coal can be utilized a great boon will be conferred thereby on those responsible for supplying power to electric railways.

The tendency of those actively connected with power distribution has been toward the development of standards for transmission and contact systems. Specifications for overhead line material, wires and cables have been revised and the requirements for crossings of power lines with railroads has received increased attention. The value of a careful study of the losses connected with power distribution has been made apparent by the greater effort toward maximum use of existing equipment. Rapid advances in the cost of labor during the year have also brought labor-saving devices into special prominence. Engineers of way have collected convincing data on the savings which have resulted from the use of various types of tools. All are thoroughly alive to the necessity of utilizing labor-saving devices to the limit in order to keep maintenance costs within reason * * *

Looking at their work as a whole our conviction is that the engineers have contributed no small share to the improvement in operating conditions on electric railways which was manifest during the past year. —*Reprinted from the "Electric Railway Journal."*

January 5, 1920.

The Coast and Geodetic Survey, Washington, D. C., issues a number of bulletin of especial interest to civil engineers. Copies of these publications will be supplied gratis on application to the bureau.

The Illinois Chapter of the American Institute of Architects is one of the most active of all technical organizations in Chicago.

Henry K. Holsman is president and the other officers of the Chapter are:

First Vice President, Thomas E. Tallmadge.

Second Vice President, Francis W. Puckey.

Treasurer, R. E. Schmidt.

Secretary, Albert M. Saxe.

BOOK REVIEW

TIMBER, ITS STRENGTH, SEASONING, AND GRADING. By Harold S. Betts, M. E. First Edition, 234 pages, 108 illustrations, 27 tables, 6 by 9 inches, bound in cloth. Published by McGraw-Hill Book Company, Inc., New York.

Wood-using industries have prospered in the United States, largely through the prevalence of timber for practically every purpose. The reasonable price led to wood construction and replacement was cheaper than using more permanent materials. With the rise in price and decrease in quality, there has come a demand for a better understanding of the actual strength of lumber, its suitability for various purposes and more information regarding the preparation for use. With the decrease in supply in some localities there has been a demand for more uniform grading rules.

It is fitting therefore that the Government, through the Department of Agriculture, should make authoritative experiments with the various native woods. Various pamphlets have come from the Forest Products Laboratory at Madison, Wisconsin, where these experiments are being made, and this volume is largely a collection of the data secured. This has been tabulated so as to be really useful to one who wishes to determine the usual qualities of any common wood, and as the conditions under which the tests were made are fully stated, the probable behavior of any local material may be closely indicated.

Among the chapter headings we find Timber Resources of the United States, Strength of Wood, Effect of Moisture and of Preservative and Conditioning Treatments on the Strength of Wood, Strength of Wooden Products, Seasoning of Wood, Grading of Lumber by Manufacturers Associations and Lumber Produced in the United States.

C. A. M.

The annual meeting of the Illinois Society of Engineers will be held January 21-23 at the University of Illinois, Urbana, at which time officers for the ensuing year will be elected.

The present officers are:

President, J. W. Dappert.

Vice President, F. W. DeWolf.

Secretary-Treasurer, E. E. R. Tratman.

Trustees: W. P. Bushnell, S. A. Greeley, M. C. Sjoblom, L. B. Barker.

Castle Post, American Legion, Robert I. Randolph, Commander, has made the offices of the Western Society of Engineers its headquarters. This post of the Legion is composed of members who served from Chicago and were connected with the many engineering problems confronting the A. E. F. The Post does not draw its membership from any one locality or section of the city or special engineering organization of the army.

Maj. Gen. William C. Langfitt, former chief engineer of the A. E. F., is a charter member of the post.

Applications for membership in this organization may be placed with the secretary, Western Society of Engineers.

YEAR BOOK

To be worth while the Year Book of the Western Society of Engineers should contain an accurate list of the names and addresses of the members of the organization. This can be accomplished only by careful compliance with the regulations of the Society in forwarding to the secretary all changes of address and occupation.

Prompt notification is an assurance that all mail will reach you on time and in good form and may save you some embarrassment when the year book is published.

THE MEMBER-SHIP.

The captain stood on the quarter deck
  And heaved a heavy sigh,
And the mate looked sad and the steward had
  A near-tear in his eye;
"Why this delay," said the boatswain's mate,
  "Why don't the skipper skip?"
But the skipper knew it ne'er would do
  Without a larger ship.

So the captain stood on the quarter deck
  And sighed another sigh,
And the size of his sighs as you'd surmise
  Increased as time went by;
Then he said to the mate in a stern clear voice,
  "Now listen to this tip,
We will never sail through the storm and gale
  Till we've got a bigger ship."

"Now get ye forth ye scurvy mate
  And hunt ye far and wide,
Till you've found a man who well can plan
  A ship for me to guide;
A ship that staunch and strong and good,
  That well can ride the main,
For what avail if we should sail
  And ne'er come back again."

Then gently spoke that worthy mate
  Unto the captain bold,
And said, said he, "You'll pardon me
  If I a plan unfold,
It seems to me now what we need
  If we would make the trip
Is not a craft of iron or wood
  But a brand new member-ship."

"Well said," the captain made reply.
  "A truth with whiskers on,
Why not embark in Noah's ark
  Or ride upon a swan;
A membership's the very ship
  That's been our heart's desire.
But tell us how, exactly how
  We shall that ship acquire."

"There lives a man," the mate replied,
  "Not far away I'm told
Who knows full well a magic spell
  Which when you feel, you're sold,
And he can launch a member-ship

The size that you demand
All off the ways in five short days
The very thing you've planned."

"Bring on your man of magic power,"
Exclaimed the captain true,
"Two thousand more we'll ask him for";
"Yiho" replied the crew.
"And if he'll do this magic thing
And get the whole town sold
Upon my life I'll hug his wife
And fill his lap with gold."

Forthwith they found the mystic man
Who owned the magic wand,
And he agreed and guaranteed
To do all that they had planned,
He chose him twenty stalwart men
And ten times fifteen more,
And told them forty-seven things
They'd never known before.

He filled them with that mystic power
Which he knew how to wield,
Till they were hep to all the pep
That you have seen revealed;
He showed them how to throw the con
And how to spiel the bunk
Till none could face the dire disgrace
That it would mean to flunk.

And then he waved that magic wand
O'er every lubber's brow,
Till young and old they all were sold
And yelled, "Let's go! Right now!"
They went and you all know the rest
'Tis marked there on the wall
They talked the talk and walked the chalk,
And who could help but fall.

Al Davis, girdled up his loins,
And with his I. C. eyes
He worked some scheme he and his team
That carried off the prize,
And Brooks lead forth his sturdy men
And sicked them on the town,
And well alack when they came back
They had pomp and renown.

But Walsh, he was the wisest one
Of all that bloomin' crowd,
And his bold team the very cream

I'm sure that is allowed;
The only reason I can find
He didn't get the prize
He lost his punch at each day's lunch,
The sunshine hurt his eye.

And at the speaker's table were
So many brilliant lights,
'Twas hard to test which was the best
For fear of showing slights.
But that is past and done and gone
And we are back today
To meet as friends and tie the ends
And put the bunk away.

The member-ship now all complete
Lies anchored off the pier,
The mate and crew and boatswain too
Now smile from ear to ear;
It was a wonderous thing to do,
But now that it is done
You'll realize somewhat the size
Of what you have begun.

You've built the ship you've long desired
It was a splendid deed,
But ere you sail through storm and gale
You must test out its speed,
'Twill never do to drift along
Where wind and tide may force,
Nor yet instead steam right ahead
Until you've mapped the course.

'Tis not enough to build a ship
And drop it in the sea,
For when that's done you've just begun
To that you'll all agree;
So let's be bound each unto each
As we meet here today
To pull so strong and pull so long
And pull in unity.

So to the captain we will swear,
And to the mate and crew
That from this day though come what may
We're for you through and through;
So hoist the anchor, worthy sir,
And launch forth on the trip,
Assured we'll do our best for you
And for the member-ship.

James Noble Hatch.

January 5, 1920.

TECHNICAL SECTION

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The Economic Future of Transportation Utilities

Are We Entering a New Epoch of Economic Relationship as Between Public, Labor, Investor and Ultimate Consumer?

A Symposium Designed to Reflect Various Angles of Problem

Introduction by JAMES ROWLAND BIBBINS, *Engineer.*
Associated with Bion J. Arnold and The Arnold Company.

Presented September 8, 1919.

Introduction purposely broad in survey. Statistics largely avoided.

DEFINITIONS:

"Utility"—A quasi-public enterprise which is a vital public necessity as distinguished from a purely independent industrial enterprise.

"Public"—The citizen body as represented by its elected authorities.

"Capital"—The investing public, represented by corporate directors.

"Labor"—The operating men as represented largely by "elected officials."

"Ultimate Consumer"—The people who must pay the market price of commodities.

"Continuing Investment"—One in which continuing service with modern efficient equipment is absolutely essential to the welfare of patrons, irrespective of the identity of operating organization or financial control, e.g., street railways, water works and other utilities.

"Terminable Investment"—one which is essentially temporary in character and so organized as to promote liquidation after a given term, such as a mining property, which is financed entirely upon mineral rights and amortized through rates during the period of operation.

*"Value"—Tangible measure of monetary credit in the open market (assuming a fair buyer and willing seller), for property or rights held, i.e., the potential ability to command legal tender in a sale or transfer free from coercive or misrepresentative influences.

*"Depreciation"—Cumulative loss or shrinkage in value of all elements of physical property occurring with the passage of time due to wear, action of the elements, inadequacy, obsolescence, change in the art, etc., which shrinkage in value is counteracted in a continuing property by normal maintenance and periodic renewals. (See Amortization.)

*"Amortization"—The process of progressively retiring a debt or evidence of liability through a given period by means of consecutive or periodic payments, which process may operate by direct cancellation of the principal in whole or in part through partial payments or by accumulation in a fund drawing interest. Thus amortization is simply an actuarial method of paying back a debt, while depreciation is the physical fact.

SOME HARD FACTS:

1. Total capitalization in railroads, electric railways, telegraphs and telephones estimated as †$27,400,000,000, this country's largest industry group except agriculture; operating revenues $5,700,000,000; steam railroad capitalization about $21,000,000,000; funded debt $12,000,000,000. Electric railways alone, net capitalization, $4,800,000,000, or $115,000 per mile of single track.
2. Urban population of United States probably 50,000,000 persons, nearly 50 percent of total. All affected by and dependent upon these urban utilities. In New England over 80 percent, Illinois about 65 percent.
3. Trust funds of principal insurance companies invested in electric railway securities, formerly "gilt-edged," estimated as $117,000,000 (34,000,000 policy holders).
4. Present shrinkage in "old line" railroad bonds 15-20 percent since 1900. Shrinkage in electric railway bonds since 1909 from 30 to 50 percent, with average yield increased from 5 percent to around 9 percent.
5. Financial credit thus largely exhausted except at prohibitive money rates.
6. Automobiles increased 1914-1918 from 1,600,000 to $5,300,000, one motor car to every 5 families and 19 persons. Good roads movement will increase this usage.
7. Per capita contribution to utility revenues practically fixed by habit and the "pocket book," which definitely restricts income (rates x traffic).

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*From "Foundation Principles of Utility Valuation with Special Reference to Resettlement," by Bion J. Arnold, Am. El. Ry. Assn., 1916.

†Nearly twice the total wealth of the U. S. before the Civil War and more than twice the public debt of the U. S. in 1918.

8. Over 5,900 miles, 13 percent or one-eighth of the railway mileage, in receivership.
9. Capital requirements per year estimated about one-quarter to one-half billion dollars for railroads and same for railways. It takes from $3.00 to $6.00 or $8.00 capital to earn $1.00 in gross revenue per year, with utility business.
10. Deficit from 2 years government operation of railroads about one-half billion dollars. Increasing in spite of unification and raise in rates which were denied under I. C. C. jurisdiction prior to the war.
11. Competition though to be the public's salvation in the old days, now discarded for maximum unification of facilities. But the economies of unification are now largely discounted, except for improvements requiring large amounts of new capital.

PUBLIC POLICY AND CONTRACTUAL RESPONSIBILITY.

1. Public policy has been set against subsidizing utility deficits by taxation, especially when privately operated. Nor has it been willing to relieve utility service of contractual burdens originally incurred in "trading" for franchises, such as paving, bridges, street sweeping and sprinkling, removal of snow and ice, street lighting, special forms of taxation, share in profits, etc.
2. Public ownership and operation simply shifts the burden to the general public with the added risk of socialization and another form of class control of the cash box, possibly no more altruistic in character than the present.
3. While rates on public funds are *now* lower than on private inflation of public credit and risk will probably raise that rate.
4. Utility service is mandatory upon companies under police powers of states and their creatures, the cities.
5. Personal service, even when contractual, though collateral bargaining cannot be made mandatory on Labor under our democratic institutions, except under martial law, which America hesitates to invoke, and properly so.
6. Thus a three-cornered fight or class war has arisen, with Capital on the defensive and with a small group of operators holding the whip hand and power to jeopardize or prevent proper functioning of the nation, the Public intolerant and still smarting under past capitalistic abuses; Labor exacting and defiant even in the face of vast public discomfort and loss and disorganization of business.
7. And thus Labor "gets even" and unloads on its erstwhile best friend and ally, the Public, which is itself; the strategic cycle is momentarily completed, but with revenues and credit impaired, properties run to economical exhaustion, service and output reduced, progress stopped. Then the "vicious cycle" breaks again.

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8. Governmental authorities in the face of the responsibility appear timid and unassertive. The element of expediency enters and Congress bows to the so-called "8-hour day" without insuring a dispassionate study of basic cause and effect. Courts are too deliberate for prompt action necessary in the emergency.
9. In the constitution of regulating bodies the Public has been too timid in the guarantee of unquestioned jurisdiction, mandatory powers, political freedom and moral courage to enforce truly economic development.
10. The normal functioning of the "balance and check" of our dual Congress and Legislatures is modified to some degree by the initiative, referendum and recall, and by progressive strikes in essential industries, all of which seems to indicate a definite trend towards further recognition of human rights in contrast to the long established precedent of property rights.

THE GREAT QUESTIONS ARE:

What remedies can be applied immediately to tide over impending receivership?

What permanent remedies can be devised to insure greater future stability?

Should responsibility for present service conditions be shared jointly by Public and Labor as well as Capital?

Far-seeing executives are asking: how far can the Public be admitted to the Directorate and shall it be Public or Labor only?

If we must have socialization in Industry, what are the specifications for fair representation, not class control from the "throttle"?

Can Industrial Democracy—"Man-to-Man"*—be applied to the utilities as a higher and self-developing type of local confederation, as it has to the other industries with marked success?

SCOPE OF THE PROBLEM:

Vastness of the problem requires decided limitation in discussion.

A. *Electric Railways.* Most compact and self-contained with all elements of Service, Rates and Investment on a relatively small scale.

B. *Steam Railroads.* Vastly more complex, involving: discrimination between strong and weak roads, small and large shippers; city and port terminal efficiency; natural gateways and barriers; delays and slowing down through divisional operation; manhandling and transshipment; warehousing and storage for seasonal movement; competition between Cities, States, Ports and Water Carriers; basis of rates, whether arbitrary (empirical) or cost-of-service; co-ordinate development of waterways and economic revision of transit routes; the branch-line problem, etc.

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*See work by John Leitch.

C. *Ultimate Problem* still more complex and obscure, involving:

Rail-water hauls, arbitraries and differentials;
Port terminal facilities, home and abroad;
Allocation of shipping and balanced ports;
Competition between nations and races.

THE ELECTRIC RAILWAY INDUSTRY. SOME VITAL FACTORS.

1. Bears a vital relation to city development, land values, distribution of settlement and factories, public health, etc.
2. Riding habit of the public is exceedingly stable, increasing with the population but ultimately limited; some claim 400 rides per capita as the maximum.
3. Revenue usually increases as the 1.5 to 2.0 power of population, based on the 5c fare, and yields on the average from $10 to $12 per capita per year, rarely exceeding $15 except in the most favorable localities.
4. Track mileage, to insure this revenue, should increase nearly as fast as the population.
5. Car mileage should increase somewhat slower than revenue. Normal expansion requires about $3.00 new capital to $1.00 additional earned per year for surface lines; as high as $8.00 for subways.
6. Time-zones and fares controlling elements in city development, 30 minutes ride usually the critical point. Beyond this other means are favored if available—e.g., steam suburban service.
7. Public has been educated to 5c fare—a psychological fact. Settlement is bound to intensify within 5c or walking zones.
8. Fare zones would have the effect of a rubber band, urging denser population within the cheaper zones, intensifying land values therein and defeating the ultimate purpose of the cheaper fare.
9. A large raise in fare checks riding. The usual practice has been:

   5- 6c, 20% gross, gives about 15% net in revenue
   5- 7c, 40% gross, gives about 20% net in revenue
   5- 8c, 60% gross, variable or actual loss
   5-10c, 60% gross, variable or actual loss

   Boston: 10c fare lost 20 percent in traffic below 1914, less revenue than with 8c.

   Chicago: 7c surface increased revenue 24 percent (1 week's trial); 6c elevated increased revenue 12 percent (7 months' trial).
10. Operating ratio of electric railway is comparatively rigid, the largest variable factor being wages, which amounts to about one-third of the income.

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11. Improvements in efficiency are practically limited to minor factors at present. Grading of service by short runs and elimination of unnecessary stops opposed by public. Effective traffic regulation opposed by teaming interests and auto owners. Abandonment of non-paying branches opposed by suburbanites and justly so. One-man cars opposed by labor and requires capital or credit. Type of motive power therefore largely fixed.
12. Depreciation little understood and usually unrecognized publicly. Matured depreciation appears as abondoned property or renewals. Former practice was to recapitalize heavy renewals or reconstruction. But Commissions now are watchful to see that excessive depreciation reserves are not used to absorb excess earnings.
13. In any liquidated property, due to franchise expiration or sale, a reserve fund should be available equal to accrued depreciation; otherwise, rates have been too low in the past.
14. Situation today is almost universal that (1) Public demands depreciated value as basis of rates and (2) is unwilling to open the door of the past. Companies have not earned sufficient to fund or underwrite their accrued loss through depreciation. They are not permitted to earn enough to start a fund now of sufficient size to grow to reasonable dimensions. Meantime, operating expenses soar and net income becomes a deficit.

POSSIBLE REMEDIES.

Various Alternatives are Suggested: Are they equitable?

1. Scaling down capital, which is confiscatory unless we admit that the railway industry so far is a losing venture.
2. Meeting operating deficits by general taxation, but thus penalizing the man too poor or unable to use the service.
3. Zone fare system, encouraging short rides, but uprooting established values and freedom of intra-city transit.
4. Labor to accept flexible profit sharing plan with reasonable assurance of corporate representation (a) sharing both profit and less; (b) sharing profits only.
5. Cities to assume special assessments and taxes such as paving, sprinkling, cleaning, snow removal, special street lighting, etc.
6. Cities to waive City's share of profits to reduce fares, pay higher wages or increase service.
7. Lease of properties to Cities so that general taxation to support deficits will become automatic, as in the case of fire, police, sanitary and water departments.
8. Co-operative trustee operation, with reasonable fixed flat fare to support at least the service charge (operating expenses) with general tax assessment to support readiness-to-serve charge (fixed charges) or the remaining deficit in fixed charges.

9. Municipal ownership and operation with the Public carrying both risk and deficit.

RECOMMENDED—THE STUDY OF HISTORY.

In the foregoing "brief summary," no definite contribution has been attempted. But the author will close with a short discussion from a viewpoint which may perhaps be novel in respect to the unusually illuminating character of the data, which are made available from the report files of Mr. Bion J. Arnold and through his courtesy.

The co-operation and assistance of Messrs. F. A. Sager and H. C. Lummis are also acknowledged.

The Story of a 5-cent Fare:

Great public movements always mature slowly. This is the case with the utilities, and anyone attempting to form basic judgments in a hurry, is at once confronted with the social problem in its ultimate aspects. Sound national diplomacy never allows itself to be stampeded; neither should public control of the utilities be unduly subjected to destructive radicalism or to the baneful influence of the reactionaries. It is only the happy medium that will perpetuate stability and this sane viewpoint can best be encouraged by the study of what may be termed the "Three Generations," past, present and future.

This may be illustrated by the investment history of a large railway property operating in one of the large cities of the United States showing in cold figures the result, on the one hand, of the corporation's policy of rapid electric development (possibly too rapid), and, on the other, of the City's determined adherence at all costs to the letter of the franchise law—the 5-cent fare. In other words, this case shows clearly the net result of the 5-cent fare carried back through nearly six decades, starting with the Civil War and ending just before the influence of the war-price boom of 1917-18 took effect.

This company started with a few horse car lines and extended very gradually until the period of electrification began, about 1890, when the property had an investment less than one-third of that of today. The lines were then all electrified; a very large proportion of the horse-car investment was abandoned during reconstruction, ill-considered competitive construction was permitted by the City, and extensions did not settle down to a normal rate until 1900, ten years later. Thereafter normal expansion continued at a moderate rate, especially in the later years.

The earning capacity of the property provided liberal operating funds and during the middle of the horse-car period the net earnings were gratifying. Then maintenance, renewals and depreciation began to mount and net earnings finally vanished altogether in 1894, when the maximum renewal and replacement expenses occurred. After 1900 favorable net earnings again appeared and (excepting during the 1908-9 panic) continued up to the time of the war, but at a much lower rate. Today, due partially to mounting renewal expenditures, the result is a duplication of the deficit in 1894, thus showing practically two complete economic cycles, during the period of nearly two generations. For the entire period, the weighted average net earned on net plant investment was as follows:

Horse car period, slightly over 8 percent (on an average investment about one-seventh of today's); electric period, about 6¾ percent.

By all rights and economic laws, we are justified in considering such a property as a permanent or continuing operating investment for the same reason that service is a perpetual necessity. Therefore, it is proper to consider the financial result throughout the entire period, referring all results to what may be termed a fair standard money rate for the funds invested. This rate will always be reflected by the money market, which is sensitized to public opinion perhaps more than any other factor in business and finance. It is a known fact that the money rate of the earlier years, when horse car traction was installed, was higher than today, due to the uncertainty regarding the future of the business and the corresponding risk to the investor. Moreover, in those days the words "depreciation" and "amortization" were practically unknown, and the future was admittedly obscured in undue optimism (on which basis fixed fare franchises were generally negotiated). Therefore, the prevailing money rate, while apparently representing net return on investment, actually represented that return minus a proper depreciation reserve. We know today, to our sorrow, that such a reserve should have been established to absorb the unavoidable permanent shrinkage in assets or plant value due to age, obsolescence, change in the art, trend of public opinion towards socialization of industry, etc.

But the Public today wants to pay only "depreciated value" for utility properties, likewise rates based upon that value. Obviously, the corporation cannot return to the original investors the principal of their investment without having in fund a sufficient accumulation to absorb this permanent shrinkage in principal, which amounts to 20 or 30 percent in a normal growing property and possibly over 40 percent in a stationary property, both of which have been operating for a sufficiently long term of years, to exceed one complete average life cycle of its principal depreciable parts. Therefore the supposed return indicated above really means a net return on investment at least 1 percent lower or about 7 percent and 5¾ percent respectively. Both rates are manifestly below the standard money market rate for new money invested in such enterprises during these periods.

Now let us assume a definite money rate (for example, 1860 to 1875, 9 percent, 1876 to 1890, 8 percent, 1891 to 1917, 7 percent), and observe the final result today. In other words, assume that the property should have earned these rates of net return, *applicable to interest only*, and carrying forward each year the resulting surplus and deficit, as the case might be, to a cumulative total as of today. At these rates, this property actually showed in 1917 an aggregate *deficit or deferred earnings* amounting to nearly one-half (45.9 percent) of the existing plant investment. The horse car period practically sustained itself *at par* up to the year 1890, based upon the above assumptions; but during the succeeding electric period, a continually increasing recession in earning power and accumulated deficit occurred, with no hope of ever "catching up," on a 7 percent net basis.

If the electric period be considered alone, an assumed rate of 7 percent net return resulted in an accumulated deficit of over 50 percent of the plant value; a rate of 8 percent, in the enormous deficit of 123 percent of the plant value.

In fact, only with an assumed rate of 6 percent did the electric property finally emerge from the long period of deficits, with a small surplus (6.28 percent of the plant value), which has since been entirely wiped out and the recession continued. And the above results do not take cognizance of the necessity of a continued depreciation reserve, only of the renewals spent or actual depreciation which had matured—i.e., unless we assume that the *net returns to the investors* were about 1 percent lower than stated above, i.e., 6 percent for the electric period, 7-8 percent for the horse car period.

Corporate deficits have to be financed somehow. In this study it is assumed that the deficits were financed during the slumps on borrowed money at the rate indicated. Similarly, annual surpluses when they occurred in the mid-periods, when the properties were comparatively new, were assumed to be put immediately at interest and credited at the same rate. Thus the zero-line of surplus-deficit indicates what may be termed PAR on the money market with respect to true operation and without reference to stocks and bonds.

Admittedly, the results are not encouraging; in fact, they point a menacing finger toward the condition of a "losing venture," as one expressing normality rather than abnormality. But the basis of a "losing venture" entirely upsets the normal equilibrium of values, cost of money, and operating efficiency. In the long run, adherence to unstable conditions of revenue, maintenance, or cost of money inevitably leads to dissipation of investment and ultimate reorganization.

The net result of this study is clear—that the 5-cent fare has not here produced stability, due largely to its gradually decreasing purchasing power.

It is idle to say that the company *should have* established depreciation funds long ago, for such knowledge as we have gained today by bitter experience is not retro-active and it is quite pertinent to raise the question whether in this property even the municipality itself could have taken over the old horse car properties, electrified them and operated them up to the present time at "par," with a 5-cent fare limit.

The problem for the future therefore is one which involves the re-establishment of stability in the industry. To jump at mere expedients, such as scaling down plant investment or lightly assuming low money rates clearly below the market rate, or fancied savings through public operation is to ignore the plain facts of history and the unmistakable trend of the present. The real solution will require more intelligent and fair-minded treatment, and it seems to the writer incumbent upon the engineering profession to lend its weight in rectifying the obvious mistakes of the banker and the lawyer in handling these technical problems of utility development, and particularly to educate the Public through all possible channels to a more thorough appreciation of the fundamentals upon which sound and stable utility operation must be conducted, whether by Corporation, Municipality, "town meeting" or soviet. The results are one and the same. We cannot escape the consequences of violating economic any more than moral laws. To the writer, these historical valuations have been more illuminating and convincing than all the volumes of opinion evidence which have been spread upon the public records. But they must be made with judgment and understanding of the conditions of the growth of the industry in adjusting physical accounting standards to present day precision. In this respect, corporate records are invaluable, and it is the writer's belief that if every utility could have opened its corporate history to public inspection, much of the prevailing misconception and lack of co-operation could have been avoided. In this particular case, the final investment determined independently and entirely from corporate records properly adjusted as above noted, came within less than one percent of the appraised Cost to Reproduce New as of the same date, using normal prices, approximately those actually paid for constructing and renewing the property.

Third Generation:

The problem of the future or the third generation requires another discussion too involved to be attempted here. Suffice it to say that it seems hardly reasonable or equitable to present to the future generations a property quite free from the burdens of past development while this same future generation is reaping enormous benefits in appreciation of values which have been brought about as a result of this rapid development largely through the agency of the utilities. In other words, each generation ought to stand on its own feet. If errors have been made, they should be reasonably allocated or distributed, which can be done as an actuarial problem without unduly burdening any period or party to the common misfortune. This policy seems to hold the maximum of fairness and equity in dealings with the co-partners of the business—Public, Investcr and Labor.

Valuation and Accruing Depreciation

By P. J. Kealy,
President, Kansas City Railway Company.

THE street railway industry of the United States has passed through a most depressing period, but present indications are that the worst is over. Constructive forces are today working towards a solution that, I am firmly convinced, will place the industry upon a stable basis and insure its continued health and prosperity. The problem has been a most difficult one, chiefly because of the fact that every particular company presented only a local case. There was no one central point to attack, nor one possible definite solution that would cover all cases. In the majority of states relief was only possible through action of state commissions. These commissions were naturally very loath to act quickly, especially when so doing meant the popular disapproval which immediately followed any effort to get away from the traditional five-cent fare. In many cases franchise fare stipulations presented further obstacles. Every company had to fight its own battles against a public opinion not educated to the exigencies of the situation.

However, the situation has changed, and one of the most hopeful signs today is the fact that the problem has ceased to be one only of local significance, but has become national. Commissions have speeded up their action. The public has become aware of the seriousness of local transportation needs—in some instances threatening the very continuation of service.

The appointment of the President's Commission to investigate the needs of urban transportation and to make recommendations has served to crystallize the entire matter into national form. Through the activities of the American Electric Railway Association and the Committee of One Hundred in Washington, the entire question has been presented to this commission from a nation wide standpoint. The National Chamber of Commerce has also taken up the question. The public mind has been educated to the needs of our urban transportation companies until in every community the necessity for some solution is now recognized.

All of these things working together open the way for placing the entire industry in every community upon a stable basis that justifies the belief that its future will be worked out in a manner acceptable to the investors and to the public.

In my mind the ultimate solution will be private operation and ownership with municipal supervision of service based upon the cost of service principle, which nesessarily will include a fair return to capital actually and honestly invested in the public service.

The cost-of-service plan primarily turns upon two fundamentals: First, that the car rider shall pay only for transportation; second, that inasmuch as one element of the cost to produce is a fixed return upon capital value, that such capital value be determined and agreed upon between the company and the municipality.

To some extent, from the standpoint of valuation, the doors of the past have been closed, and the entire transportation problem is in a fair way to be put upon a present and a future basis. The valuation cycle has progressed far enough so we can be at least hopeful that the standards in many cases being adopted, and which include the points developed in the recent report of the Valuation Committee of the American Electric Railway Association, will govern the majority of future valuation proceedings. Although the whole question of valuation is complex, its basis of common honesty and fair dealing is becoming universally recognized. We have traveled a long way from the principles established in the beginning by the Wisconsin Commission, where valuations for rate making purposes were made on the depreciated physical value plus some additional allowance for a going concern. The trend of rate making today is away from the idea of basing rates on depreciated value. It is now recognized that it is a physical impossibility to keep any property maintained to a condition where no depreciation exists; that no property can possibly be maintained at more than 80 to 90 per cent of its cost new value, and that when maintained to that condition it will, as far as the public is concerned, be giving 100 per cent service. In basing rates on the depreciated value of a property the investor is not only penalized in that at least 20 per cent of the investment which he never had an opportunity to recoup is being confiscated, but the public also suffers. From the latter viewpoint, if, in determining fair value, accrued depreciation is deducted, in the future the rate of return must be sufficient to include an allowance for future depreciation accruals, yet such accruals can never be used for public benefit, since it is impossible to keep the property maintained at more than 80 to 90 per cent physically good. Therefore it follows that it is more expensive and increases the cost of service for the public to pay the principal by paying for accrued depreciation than to pay interest on the cost new value without deducting depreciation. Furthermore, it is now recognized that depreciation charges have nothing to do with capital account but are chargeable directly to operation.

The Wisconsin Commission, which first originated the principle of basing rates on depreciated value, has within the past year abandoned this theory. The Buffalo Arbitration fixed values entirely on the cost to reproduce new. The Missouri Commission has similarly expressed itself, and in a recent case states that henceforth all valuations in Missouri for the purpose of rate making would be on the basis of cost to reproduce new. This position is economically and morally sound, and I believe is one which will be made the basis for all future valuations of traction companies for rate making purposes.

From every present indication the future of traction companies lies along the way of private operation based on the cost of service with sufficient public supervision to insure proper costs and adequate service. The car rider should not be made to pay for anything but transportation. This means traction companies shall be relieved of all indirect taxes, such as paving charges, sprinkling, snow removal, and other taxes of like nature. It implies a fair agreed valuation upon which the car rider will pay a reasonable return; it further implies public supervision and a reward to management for efficiency.

There can be no proper argument advanced why transportation should be furnished at less than it cost to produce, and the deficit made up by taxation. If this is reasonable, then it is reasonable to go a step farther and say that transportation should be assumed by the municipality and furnished free and all expenses borne by taxation.

The street railway problem is in some ways a psychological one. Although the fetish of the five-cent fare has been successfully abandoned, its memory still lingers. A raise in rates has generally meant that there is a loss in the number of passengers carried. In other words, in order to register a mental protest against a fare increase, many people resort to the sidewalks. These same people, however, do not refuse or object to paying the price asked for any other product, and in no other line of business other than transportation has increased price meant decreased volume. This attitude is changing and will continue to change for the better. Just as soon as the public becomes thoroughly convinced that in order to have urban transportation the cost must be paid by the car riders, our short hauls will come back. Mixed with this has been an element of ill will and suspicion. Politicians and newspapers have played upon fare increases with the result that the public has heretofore thought that it meant an additional gouge. There has existed in the public mind doubt as to the actual cost of the service. However, this should be temporary. The present national investigation will clarify the situation, and the cost-of-service plan presupposes a new basis for our dealings with the public. Service costs and service standards will be set up under public authority. There will be sufficient checks and safeguards to assure the riders that in paying the ruling fare they are only paying what the service cost plus a fair return on an agreed and established capital investment.

Whether or not a satisfactory solution can ever be made for labor is a question that will always be doubtful. If the future is to be judged by the experiences of the past twenty-four months there seems to be no way of satisfying labor. The demands of the union have already upset settlement after settlement that seemed to promise results. There is one element, however, in the situation that may curb further unreasonable demands, and that is public opinion. In the past the public in paying a fixed fare was very little concerned with the troubles between the traction companies and their employes as long as service standards were maintained. In general the public sided with labor for the simple reason that, paying a fixed fare and receiving good service, it was not directly affected. However, under the cost-of-service plan all this will be

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changed, and when the public once realizes that further wage increases and work-day changes are immediately reflected in the cost of service, public opinion will be interposed to offset unreasonable demands. It has frequently been said that many of the troubles of public service corporations can be traced to "the-public-be-damned" attitude of a decade ago, whether this is true or not, and it will be very interesting to see what will be the result of "the-public-be-damned" attitude of labor.

It may be that the zone system is the solution in some localities, although as yet it has not been given sufficient trial in the United States to draw definite conclusions. The great majority of our cities have grown upon the basis of one fare and it will be an extremely difficult matter to change the very fundamental upon which their growth was predicated, that is, the one fare system.

There is this much that can be said upon the future of our transportation systems: They are absolutely essential to the growth and development of our cities; there is nothing today or in the near future that can take their place; what is necessary to our present civilization will be continued and maintained. The entire industry is today going through a settling process that will put it upon a more secure and stable foundation than ever before. Being removed from a local status to a national one, valuation and other standards will be more easily adopted. The public, to the extent that it will be given a more direct control of service and have the assurance that it is paying a fair price, will to that extent assume the responsibility for this service.

The investor will find a future that will assure him of a fair if small return upon the money he has actually invested to give transportation service to our cities. The public will be satisfied because it will have the assurance that it is paying for the service which it demands a fair price based upon its actual cost and that it controls more or less directly the character and extent of its service. Labor will be made to realize that it is engaged in a public service and that public welfare must be considered. It will be paid a fair wage for a fair day's work and unreasonable demands will be met by the withdrawal of public support. The door of the past, I believe, will be closed not only upon obsolete valuation methods, but upon all of the old prejudices which have been the outgrowth of past mistakes and past policies. The urban transportation industry will be established on a business basis in which it will receive a fair price for a service absolutely essential to the well being and growth of our cities.

The Actuarial Problem

By John Jirgal,

Of Hagenah & Erickson.

I CAN assure you that Mr. Hagenah, who was to take part in the program, deeply regrets his inability to be here this evening. Had he been able to be in attendance, I am sure he would have had much of interest in the street railway situation to tell you. As it is he has asked me to come here and say a few words on the subject that was assigned to him.

This is my first appearance before an assembly of engineers, and as a member of a profession which is co-operating with you in working out the many problems of regulation I welcome the opportunity to be present at the discussion this evening. The subject which has been assigned to me is "actuarial problems." The terminology used suggests the accounting treatment of depreciation. Before taking up the subject matter itself, a few explanatory statements may be in order.

The accountant finds many theories advanced with respect to the handling of depreciation, such diversity in theory depending upon whether rate, taxation, condemnation or capitalization cases are under discussion. There are also mistaken opinions as to just what is the accepted accounting practice on the subject. For instance, the assumption among many engineers is that when reservation is made for depreciation, a fund is actually established which fund is represented by cash or securities. Such fund is further assumed to be available at all times for the purpose for which it is created and any balance which is unused is assumed to be earning interest. In practice the utilities which have established funds are so few as to be exceptional in this regard. The predominating practice is to establish a reserve, which reserve when scientifically set up merely measures the utility's liability for depreciation which has accrued at the present time but which will be realized at some time in the future. The annual allowance is deducted before the investor receives any compensation because it is only in this way that enough assets are retained in the business to meet the renewal and reconstruction obligations of the utility.

When depreciation first received the attention of the accountant the annual allowance made for this purpose was looked upon merely as an equalization over yearly periods of expenditures which were large and occurred at irregular intervals. It was found, for instance, that the income available for returns on investment were very large in one year while in the next year the utility would probably not earn bond interest. In order to correct this condition of affairs the accountant conceived the idea of setting aside annually about the same amount for depreciation. The amount so set aside was designed to be sufficient over any given number of years to meet all payments for renewals and replacements. The amount over and above such requirements was either left in the reserve or used for other purposes.

About 1907 the period of regulation was ushered in and at about the same time investigations along other lines were being carried on. The outcome of these investigations was the foundation of certain theories of equitable relations between investors, consumers, taxpayers, etc. The result of all these investigations, as far as the accountant was concerned, was to convince him that a more scientific analysis of depreciation requirements must be made in order to insure the payment of renewal and replacement obligations and also to provide for the accrued depreciation which the commissions at that time stated was deductible from the cost of the property in determining the amount upon which the utility was entitled to earn a return. The most natural thing to do under the circumstances was to examine the causes for depreciation and in order to obtain reliable information on the subject the accountant turned to the engineer for data. The result of extensive investigations was the formulation of the life method of making annual appropriations for depreciation. This method of appropriating income, at least in a measure, insured a reserve balance which approximated the accrued depreciation in the property. Many utility companies soon found that their reserves were not sufficient to meet the estimates of commissions on the amount of depreciation, and plans for increasing the reserve balances to correct this shortage were considered. In cases where surplus earnings had been retained in the business large appropriations were made from such surplus to depreciation reserve. In many cases surplus was not available for this purpose and these cases accordingly became a matter for special treatment. The fact that sufficient surplus was not on hand for the transfer noted above in no way meant that an insufficient return had been earned. The amount which should have been in the reserve for depreciation may have been misappropriated or some other disposition may have been made of it.

The above explanation has been made because it has a peculiar significance in connection with the question of accrued depreciation. As noted the accountant is concerned only with the establishment of the utility's liability for accrued depreciation and the retention of enough assets of whatever description in the business to meet in some way the realized or maturing depreciation. He keeps no specific funds for that purpose alone, but on the contrary by the very nature of his entry permits the temporary use of the reserve for many purposes. When renewals are actually made these temporary borrowings are in effect repaid although there is no transfer of funds. In order that this point may be clearly understood the following explanation of the accounting practice with respect to this item is made: It can be assumed for purposes of illustration that a utility has a plant investment of $100,000 against which stands a mortgage represented by bonds to the full amount of such investment. If $10,000 is set aside for depreciation each year and the depreciation reserve so created is invested in new property the utility has at the end of five years a property investment of $150,000, a bond indebtedness of $100,000 and a depreciation reserve of $50,000. At this point the utility may be called upon to renew property worn out in the service to the full extent of the $50,000 provided for depreciation. It is plain to see that there are no funds in the way of cash or liquid assets to pay the cost of renewal, but there is a plant investment which is in excess of the amount contributed by investors as represented by bondholders. The officers of the company, therefore, go to the trust company and request an additional $50,000 of bonds for the additional amount of property expenditures. From the proceeds of the sale of such bonds they receive $50,000 in cash which is used to pay for renewals. This transaction wipes out the cash account and the depreciation reserve and leaves a plant investment of $150,000 and a bonded debt of $150,000. In this example the entire reserve is used up for illustrative purposes only. If it is properly set up such reserve would always have accumulated the accrued depreciation.

The above explanation has been made because it has an important bearing from the accountant's view point, on the question which I am asked to discuss this evening. Such question has been prompted by the situation in which street railway companies at present find themselves and from the explanation which has thus far been made it can be seen that even if a company had in its depreciation reserve every dollar of accrued depreciation which it was estimated it should have, it might not be in a position to make renewals and replacements which are urgently needed. This is so because the earning power of the street railways may be so reduced that no investor will risk his funds no matter what additional investment has been made in the property. This is only another way of saying that investment funds are prompted by two consideration, i. e., the cost or value of the property and its earnings power. Both must be present in order to attract funds. If the earning power of the property is so low that there is danger that even the interest on the funds contributed will not be paid, then there is no hope of securing such funds and the renewals and replacements must necessarily be deferred until funds are available. The first step, then, is to increase the earning power of the property, and this can be done under the present system only by an increase in the rates of fare.

Now it may be that the accountant's method of providing for depreciation is to be condemned for this state of affairs, but it has been based upon the reasonable assumption that the street railways would always be able to earn sufficient to pay a fair return on their investment. If the failure to do this should permanently obtain, then not only the depreciation policy of the accountants must fail, but the entire undertaking must do likewise.

The conclusion to be drawn from what has been said is that a street railway company which has provided for depreciation in the manner stated may still be unable to make renewals and replacements because the assets which have been withheld from dividend appropriations may not be convertible into that liquid form which is necessary to make payments for such renewals and replacements. This explanation is necessary because the absence of funds for these purposes may be temporary only and such funds may be later provided should the earning power of the street railways return to their former level. When it is stated, then, that street railways as a class have not earned the accrued and maturing depreciation, it is important to distinguish whether what is meant is that no cash funds are on hand for renewal purposes or whether the amount earned each year has been such a percentage on reasonable property cost as not to permit of depreciation reservation.

Having thus stated the accounting method of handling depreciation there is presented this problem: "Should each generation bear its share in developing the art?" I think that the answer to this query with some qualifications can be made in the affirmative, and this for three reasons.

(1) Because each generation and in fact each year and month within each generation is responsible for the using up of property in direct proportion to the demand which it makes upon the service.

(2) Because at any given moment the investment in a utility must be found intact so that transfer of ownership will not result in loss to any of the parties; and

(3) Because it is only in this way that continuity in service is guaranteed.

The analogy between the use of coal and the using up of property has often been employed in connection with the subject of equalizing depreciation charges. The former is used up in one round of production while the later is utilized for many such rounds. The time element constitutes the only difference in extent of utilization. If, then, present or past consumers of the service have used up the property, they alone should be accountable for that portion of the depreciation which has been incurred in rendering them service. To defer or shift any part of this burden is to permit in effect the use of part of the service without compensation. Equity, therefore, demands that each consumer in each period of each generation shall bear his full share of the maturing or accruing depreciation. In other words depreciation must be provided for currently.

This current provision has an important bearing on our whole transportation problem. Our corporate form of management is such that the investors in any undertaking are constantly shifting. Especially is this true of that portion of the investors which is in active control of the management. If accrued depreciation is not provided for currently there is always a question as to who is responsible for the shortage. If dividends are declared before depreciation is provided for, then the more conservative stockholders who follow in control must not only make the depreciation allowance for which they are responsible, but they must also provide for the shortage in the depreciation reserve as well. The public deals only with the property as a continuing entity and, therefore, is not concerned with changes in management in so far as such changes effect responsibility for depreciation allowances. To the investor, therefore, the current reservation for depreciation is exceedingly important for it is only in this way that his investment is protected. This situation is more fully appreciated at the time condemnation proceedings are under way. When the property is taken over by the public the present value determines the price to be paid for such property. Whether we agree that this is the proper basis or not, the actual facts are that the commissions consider that accrued depreciation is deductible in determining value for condemnation purposes. If this is so, then the investors in the property at the time of public acquisition must either have the accrued depreciation provided for or they must accept a purchase price which will not represent their full investment. From what has been said above it is, therefore, highly important that at any given moment the investment shall be found intact and this end can only be attained by means of an allowance for depreciation provided for currently.

By far the most important reason why each generation should bear its share of depreciation is that it is only in this way that service can be made continuous. As stated above the setting aside annually on a life basis of an amount for the depreciation of any given unit provides a reserve which, when the unit goes out of service through the action of the agencies of depreciation, permits of its replacement. In other words continuous service cannot be guaranteed unless provision for continuation is made in advance. The present generation, therefore, not only pays for the depreciation for which it is responsible, but also insures continuous service for itself and for future generations. The difference between providing for each generation's share of the depreciation cost and providing for continuity of service is that the former implies depletion, while the latter recognizes that the service is permanent. The importance of continuity of service is lost sight of by those advocates who recognize in matured depreciation the only loss in value which has taken place. They neglect the important factor that when this year's earnings are not sufficient to provide for renewal expense there is no other provision by which such expense can be met. To defer such renewals, that is, do one part one year and another part the next only results in poor service. When large scale renewals are being considered, as is often the case with street railways, to defer payment amounts to financing in anticipation of some future contingency—the contingency in such case being that enough revenue will subsequently be earned to care for present renewal obligations. This, it appears, would be an unsatisfactory financial expedient and would in all probability find little favor with bankers. The only satisfactory method, therefore, is to insure continuity of service by providing for depreciation in advance.

In summary of what has been said above it may be stated that depreciation should be provided for currently because it is incurred currently, and because it is only in this way that the investment can be kept intact and continuity of service for the present and future generations assured.

But the argument may be advanced that granting all this the situation may still obtain that a utility has been unable to earn sufficiently to provide for any but maturing depreciation. If this fact can be established it would seem that the rate making base would have to ignore the depreciation element or provide for an allowance by way of going concern value. This argument obtains only in cases where commissions have established depreciated cost as the most important evidence of value.

During the past year increased consideration has been given to cost of reproduction new and original cost as the most important evidences of value while the advocates of depreciated cost appear to be losing ground. The tendency appears to be toward an annual allowance for depreciation based upon the sinking fund method with undepreciated cost considered as the most important element in value determination.

To those commissions which consider accrued depreciation in valuation matters it is important to submit evidence as to whether depreciation has in fact been earned, and this can only be done by an examination of the records covering the entire history of the property. The importance of such examinations is not fully appreciated at the present time. The utilities are inclined to the cost of reproduction as their best basis for valuation claims. The historical data are considered as secondary and very often ignored. The commissions passing on these matters must often content themselves with mere statements of historical facts without much in the way of exhibits and quite naturally because of the intangible character of such statements they choose to ignore them.

When the historical facts are available it is a simple matter to make a yearly allowance for depreciation such that when the renewal and reconstruction charges which have been incurred are taken into account there is left an amount which represents the accrued depreciation either on a straight line or a sinking fund basis, the basis used depending upon the theory of value held by the regulating body. In order to avoid distinguishing between repair and renewal charges the yearly allowance made should be sufficient to cover both items. This is more in accord with present day street railway accounting practice and has the advantage of eliminating all disputes on the method of handling maintenance and depreciation items in the past. If one allowance is made to cover both items all charges of whatever nature which have to do with maintaining the property in service condition can be made against such allowance.

In conclusion I may be permitted to emphasize that it is highly important in matters involving depreciation and valuation to have historical facts at hand so that claims with reference to the property can be definitely substantiated. Old records which may appear to have little connection with present investigations may be useful in settling matters now very much in dispute.

Electric Railway Policy

By George Weston, *Consulting Engineer.*

"ARE we entering a new epoch of economic relation as between Public, Labor, Investor and Ultimate Consumer?"

An introductory historical synopsis referring particularly to the rate of return and its relation to proper depreciation future for maintenance will be presented.

I have been requested to give a brief discussion of this question as it applies to Electric Railways following something along the discussion of "the attitude that Electric Railways can take as to various means of relief."

"Can industrial democracy supplant collective bargaining with electric railway properties?"

"What is a fair division of responsibility between the Public, Labor and Capital?"

The request also includes "a presentation of the situation as it is developed in Philadelphia."

It is further stated that a speaker will be present to take up the "Railroad Corporate Policy" and one to discuss "Valuations." This subject is such a broad one that it can hardly be scratched on the surface in its discussion during the time limit allowed, and the subject as assigned to me cannot be properly covered without reference being made to the question of Valuation and the general relations between Capital, Labor and the General Public.

I will cover briefly the subject for the period of time mentioned—about twenty minutes—reserving the right to supplement my remarks by oral discussion or a subsequent written discussion if I am privileged to do so.

With respect to the present general financial situation of Electric Railway properties in the United States and "the attitude that Electric Railways can take as to various means for relief." The first and most important matter is the question of cordial and satisfactory working relations between employer and employe—usually referred to as industrial democracy or co-operation. I will discuss this subject quite fully later on.

The next most important item is the one of expenditures. A most careful and scrutinizing examination should be made of each item of operating expense and all lost motion, waste, time and effort eliminated.

The next most important matter is the attitude toward and the relations with the general public.

"Street car riding is a habit which can be encouraged."

"Co-operation in this, as in all other matters, will work wonders."

"The Management must provide the best car service for the greatest number of people at the lowest possible cost."

"Conductors, by alertness and courtesy, must endeavor to make the street car ride an agreeable experience to the passenger—A SMILE ALWAYS HELPS."

"Motormen must watch out for passengers and space the cars to catch the short distance riders—PICK UP ALL THE NICKELS."

"Employes generally must never miss a chance to HELP WIN THE PUBLIC."

The attitude toward the public by the management through the duly authorized officials representing the City, State and National Governments should be one of frankness and a desire to impart to them full information so they will understand the problems and difficulties under which the Electric Railway industry is working, and these public officials should take a fair business-like attitude toward the utilities and consider that they are commercial propositions the same as any other legitimate business undertaking, and, in fact, should receive more painstaking and careful consideration because they are utilities serving the public under Municipal, State or Governmental supervision, and in the question of valuations, for instance, a "public utility property is entitled to repayment for all of its property consumed in the service of the public," and what I am saying here refers to the public question propounded, "What is a fair division of responsibility between the Public, Labor and Capital?"

There has been in the past too much of the "pound of flesh" spirit displayed by many representatives of the public in dealing with public utilities.

Every time a question of franchise renewal or adjustment comes up, or one of raising fares to meet increased operating costs, a propaganda is immediately started about watered stocks and high capitalization and in the valuation nothing must be considered but property "used and useful in the service of the public" at prices averaged over a period of years less "accrued depreciation" and brought down to what is termed a present value—an absolute confiscation, as a rule, of from 20 to 50 per cent on the average of the actual value of the property for rate making or sale purposes. Sufficient time is not allotted to me to fully discuss this important subject of valuations, but I will refer you to the report of the Committee on Valuation of the American Electric Railway Association recently published in which view points, fundamentals and text I fully concur:

Accrued Depreciation.

The prevailing practice in making valuations for rate making or upon which to apply rate of return, adopted by Public Service Commissions and other public utility supervising bodies in the past has been "cost to reproduce new, less depreciation."

There has been little argument between the companies and those representing the public about correctness of inventories. More differences have arisen with respect to proper unit prices to apply and differences of opinion respecting proper overhead and "going value" percentages, also with the method of determining the amount of depreciation to be deducted, if any.

Depreciation has been classed by all students of the subject to be an operating charge and not a capital account item. The only provision that can be made to take care of depreciation is by making proper repairs and proper renewals when necessary and these expenditures should be charged as an operating expense; that is, in the case of renewals the original cost of the thing replaced should be charged to renewals and any excess or betterment is a proper charge against capital. The integrity of the capital investment is thereby maintained against depreciation to the extent practicable or economically possible. An exact standard of percentage physically good to apply to any well maintained electric railway property is difficult to establish because this percentage will vary in different properties influenced by different types of property and equipment, the physical characteristics of soil and other local conditions and usage. A property consisting of a large percentage of elevated or subway construction will show a much higher percentage physically good of the total investment than a surface electric railway property.

Every public utility property should be maintained at 100 per cent *operating condition*, but it is both impractical and uneconomical to maintain any property approximately 100 per cent *physically good*. This for the reason that the physical per cent good of any property will vary from approximately 100 per cent, in the case of a new property, to 80 percent or less in an older property, depending upon the age, the different stages of renewal cycles through which the property has passed, and the amount of additions and betterments which have been added.

There is a certain amount of total accrued depreciation that never can be taken care of in any operating, growing property. In other words, as stated above, the only practicable, economical expenditure that can be made to offset depreciation is to make repairs and renewals when physically necessary. There can be no fairness or logic in attempting to penalize a company because it has not done the impossible. The full original investment remains in the property and the investor is entitled to a return upon every dollar until the investment is repaid to him. Where a property has not been kept in good physical condition and there is unmistakable evidence of "deferred maintenance" found in any property, the subject should receive special consideration, and if the property being valued has been a prosperous one in the past and the fact is in evidence that the money that should have been expended for renewals and repairs has been diverted to other uses of benefit to the company, the company should be required to make good this deferred maintenance, the cost to be charged to its individual account and not to operating expense.

If, on the other hand, it can be shown that any company carrying "Deferred" maintenance has been well managed, but that the income has not been sufficient to pay the increased costs of operation, franchise obligations and interest and, in addition, to properly maintain the property, then provision should be made in any rate adjustment to permit the company to earn the amount necessary to put the property in good operating condition.

Your committee wishes to emphasize its conclusions with respect to the subject of accrued depreciation in the strongest manner possible, as follows:

Where a property has been maintained in good operating condition and an appraisal is being made to determine investment value for "rate making" or for sale to municipality, state or government, no deduction should be made for accrued depreciation.

I will combine the question "can industrial democracy supplant collective bargaining with Electric Railways properties" and my references to the operation of the co-operative plan in Philadelphia. First, collective bargaining does not conflict in any way with the successful operation of a proper co-operative plan.

As an introductory I wish to state there can be no question but that the day has arrived when labor, through some co-operative plan, wherein the rights of the general public will be fully guarded and protected, must be raised to a position of more direct participation in the management of operating conditions that affect their personal welfare, and to enable them to more fully participate in the equitable distribution of the earnings which they help to produce. This should not be accomplished through the workings of a dictator but through co-operative endeavor.

When labor is made a working, participating partner in the business, it must assume its portion of the burdens, responsibilities and obligations, and positive provisions should be made in any plan for serious consideration that will prevent strikes on public utilities and insure to the general public continuity of service at all times.

This latter paragraph is one of the most important relating to the public utility situation today, the abolition of the strike. "Strikes," like wars, should be abolished. Why send the flower of our young manhood to Europe to offer up their lives and spend billions of money besides to help democratize the world and establish peaceful arbitration between nations as a substitute for wars and tolerate a system of warfare to exist between different elements of our own social organization in the way of "strikes." Wars were necessary to civilize the world and similarly probably "strikes" were necessary to bring Capital to realize that Labor is its "chief ally."

This is not a new subject to me. Three years ago next December I read a paper before this society entitled "Industrial Democracy with Particular Reference to the Relations Between Capital and Labor." In reading the paper today one must remember the conditions existing at that time with the Adamson law pending before Congress, but the fundamentals covered in that paper hold good today.

A Look Forward

The Stotesbury-Mitten Management, as a result of the past seven years' experience, now presents the following statement of policy and practice which it is proposed shall hereafter cover the joint undertakings of the Men and the Management in the way of co-operative effort.

The principle of the Co-operative Plan of 1911, i. e., that employes may belong to any union or other organization without "let or hindrance," is hereby ratified and confirmed; it being understood, however, that in the interest of service to the Public, the rules of the Company must be obeyed.

Satisfactory service insures continuous employment with the Company. In the event of there being such a decrease in the business of the Company as makes it necessary to reduce the force, those giving the least satisfactory service shall be the first to be dropped from the pay roll of the Company.

There shall be no discrimination against employes who, for any reason, do not become members of the Co-operative Welfare Association.

Co-operative effort is recognized as the keystone of all accomplishment in rendering proper service to the Public and good service will be recognized by such advancement as opportunity offers.

WAGES.

The War Labor Board, in its wisdom, determined upon an advanced wage for employes of street railways. This Management, in agreement with the Co-operative Committee, advanced the wages of its trainmen another 5c. to a maximum of 48c. per hour, and has adjusted the wages of its other employes accordingly. This at once brings all employes upon a proper comparative basis and, by averaging the wage scales of the other cities of the first class under the jurisdiction of the War Labor Board, viz., Chicago, Cleveland, Detroit and Buffalo, gives us a permanent basis upon which to adjust the wages of the employes in each of the departments, from time to time as occasion may warrant.

This new basis makes unnecessary the longer continuance of the 22 per cent Fund and opens the way to a broadening of the Co-operative Plan to include all employes of the Company upon equally favorable terms.

The original Co-operative Plan, covering the payment of sick benefits, now provides insufficiently in amount and imperfectly in time and method of payment. The first plan of death benefits and of pensions became inadequate and subject to much improvement.

Therefore, we must now devote our energies to enlarging the scope of the Co-operative Welfare to include all employes one year in service, and to increase and improve sick benefits, death benefits and pensions.

The Government has been good to us in various ways. The War Labor Board has dismissed the complaint of those who were desirous of destroying our efficiency. The Emergency Fleet Corporation and the Bureau of Industrial Housing and Transportation have advanced us millions of dollars with which to buy new cars and other equipment.

The Stockholders have permitted us to increase wages of train-

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men more than $5,000,000 over the amount which the men would have received under the 1910 strike settlement scale. The Stockholders themselves have received less than $3,600,000 during the seven years, as a return upon their $30,000,000 of invested capital, and have now again let us advance wages to meet the needs of the men, and this without knowing where the money is coming from.

The bounden duty of the Men and the Management under these circumstances is to do their level best to cut out all wasted effort. Man power and fuel can be thereby saved. By helping the government to conserve these most essential things we will not only be doing our patriotic duty, but in addition will be doing all in our power to hold down our rates of fare to the lowest possible point consistent with the following:

1. Efficient service to the Public.
2. Payment of adequate wages.
3. Proper protection of invested capital.

COMPENSATION FOR INJURIES.

The Company will continue to pay the compensation as determined under the "Workmen's Compensation Act" for injury to employes, resulting in:

1. Total temporary disability.
2. Partial (permanent or temporary) disability.
3. Limited number of serious dismemberments.
4. Total permanent injuries.
5. Fatal injuries.

The period and amount of compensation are determined under this act in accordance with the disability sustained.

AMENDED PLAN.

The Co-operative Plan of 1911, redrawn to meet the changed conditions, follows and will be known as the Co-operative Plan of 1918.

COLLECTIVE BARGAINING

VOICE AND VOTE

1. The workers shall have a free and independent vote for representatives for proper collective bargaining, and

2. Proper committee organization of such representatives so that class and group contact may be assured and the integrity of workers' committees be established and maintained as such.

PROCEDURE

The business of Employer is divided into classes or Departments and each Department is subdivided into contact groups or Branches.

Differences between Employe and Employer shall be settled through the medium of

1. Branch Committees.
2. Department Committees.
3. General Committees.
4. Board of Arbitration.

Any local point of difference shall be taken up by the Branch Committee at the local Branch of origin.

When a grievance is not settled through the proper Branch Committees then it shall be taken up by the respective Department Committees.

When a grievance is not settled through the proper Department Committees then it shall be taken up by the General Committees.

When a grievance cannot be settled through the General Committees it shall then be settled by arbitration.

All appeals shall be submitted in written form to the Secretary of the respective Committees, briefly setting forth all the facts of the matter at issue.

In the discussions of the Department Committees and of the General Committees it is intended that Employes shall sit on one side of the table, so to speak, and Employer on the other side, throughout the collective bargaining contemplated by this Plan.

The majority of any Committee of Employes shall be the voice of that Committee.

The majority of any Committee of Employer shall be the voice of that Committee.

Whenever the minds of the majorities of any Committees meet, the controversy shall be settled.

While it is intended that there shall be full and free discussion in order to arrive at an amicable understanding and settlement of controversies, whenever it is necessary to take a vote to ascertain the voice of any Committee, the Committees for the Employes and for the Employer shall have the right to retire and cast their vote in secret caucus. In such secret caucus all such votes shall be taken by secret ballot, said ballots to be returned unopened to the Secretary for the Committees. The Secretary shall count the ballots under the observation of both Committees and announce the result in open meeting.

Branch Committees

There shall be elected two representatives by the workers at each depot, station or division. The candidate receiving the highest vote shall be declared No. 1 Branch Committeeman for that depot, station or division for the ensuing year, and the candidate receiving the second highest vote in like manner shall be declared No. 2 Branch Committeeman.

The employer shall appoint two representatives for each depot, station or division.

The two Committeemen elected by the workers shall constitute the Branch Committee for Employes. The two representatives appointed by the Company shall constitute the Branch Committee for Employer.

Committeemen shall be elected to serve for the period of one year. It shall be their duty well and truly to represent their fellow employes and to give all matters under consideration or discussion their best thought and the benefit of their knowledge and experience.

At least once in every three months there shall be an opportunity for a meeting of workers at each Branch, when reports shall be made by the local Branch Committeemen.

Elections.

The dates upon which Committeemen elections shall be held, as well as the hours during which the polls will be open, shall be so arranged as to insure to every qualified voter at the local depot, station or division opportunity to cast a vote for one candidate, it being stipulated that the different election dates shall be arranged in such order and sequence as to provide always for a working majority on the several committees of members who are familiar with the nature and routine of the business transacted.

Notice of any Branch election shall be posted conspicuously at the said local Branch twenty-one days in advance of the date set for the election.

All elections for Committeemen shall be by secret Australian ballot under the supervision and direction of an Election Committee of three members chosen by and from the respective Department Committee for Employes.

All ballots cast, together with the official return of the Election Committee, shall be forwarded promptly to the Secretary of the Department Committee to become a part of the permanent records.

In case of decease, leaving service or inability to act of any Branch Committeeman, the remaining Committeeman shall act until a successor is elected. An election shall be held to fill the vacancy as promptly as possible in the same manner as the original choosing provided by this Plan.

Qualifications for Voters.

To qualify as a voter the employe must have been six months in the Company's service, be regularly assigned to duty, and not occupy an official position of any character with the Company. Every voter shall be entitled to all the rights and privileges under this Plan.

No voter shall be permitted to cast a ballot unless he or she shall appear at the polls in person, and within the hours prescribed for the election.

Lists containing the names of the workers qualified to vote at the election shall be posted conspicuously at the local Branch three days prior to the date set for the election.

Qualifications for Committeemen.

Candidates to be elegible to election as Committeemen must be regularly assigned to duty and have been continuously in the employ of the Company for not less than two years.

In the Transportation Department candidates must also be assigned to a regular run and be actually serving in the capacity of traiman or its equivalent grade.

Candidates for election as Committeemen must file with the Secretary of the General Committees, not less than thirteen days in advance of the date of election, official nomination papers, carrying the signatures of not less than seven workers qualified to vote at the respective Branch location.

It is not intended that a worker shall sign more than one nomination petition at any election.

It is not intended that any employe who may properly be said to represent employer shall be chosen as a representative of workers.

DEPARTMENT COMMITTEES

Employes in the several Departments shall be represented on their respective Department Committees through their duly elected members.

The following Departments will each be represented by its respective Department Committee, viz.:

Transportation Department.
Rolling Stock and Buildings Department.
Electrical Department.
Way Department.
General Offices Department.

These Committeemen elected annually by the employes of each Department shall be equaled in number by the Company appointments of its representatives. Each Committeeman shall be entitled to a vote.

Each Department Committee for Employes shall consist of all No. 1 Branch Committeemen and all No. 2 Branch Committeemen elected by the workers at the several depots, stations or divisions in that Department. In the event of decease, leaving service, or inability to act, of either Branch Committeeman, then the remaining Branch Committeeman for that Branch shall act on the Department Committee until a successor is elected in the manner hereinbefore provided for filling a vacancy on a Branch Committee.

OFFICERS.

The Department Committee for Employes and the Department Committee for Employer shall each elect its respective Chairman.

The Secretary for the General Committees, or an authorized representative shall act as Secretary for the several Department Committees, without vote.

MEETINGS.

Stated meetings of each Department Committee shall be held in alternate months throughout the year. Special meetings shall be held at the call of the Secretary or upon the request of five members submitted in writing to the Secretary.

No less than two-thirds of the members of any Department Committee shall constitute a quorum for the transaction of business at any regular or special meeting of that Committee.

January 5, 1920.

GENERAL COMMITTEES

The members of each Department Committee for Employes shall annually elect two of their number, the members so elected to constitute the General Committee for Employes.

The members of the General Committee for Employes shall be equaled in number by the Company's representatives, to be appointed by the President of the Company, the members so appointed to constitute the General Committee for Employer.

A vacancy occurring in the General Committees shall be filled as promptly as possible in the manner of the original choosing.

It shall be the duty of the General Committees to devise ways and means for furthering the efforts of the various Department Committees for the greatest possible good, to promote harmony and good fellowship among all employes of the Company, to formulate plans for submission to the several Department Committees, and to render every assistance within their power toward advancement of the interests of the employes and the betterment of the service.

Further, the General Committee shall possess the power to review, modify or reverse any findings or decision of the Department Committees, and may, in their judgment, change any portion of this Plan or any modification thereof or the composition of any of the Committees, or any of their various respective functions.

The scope and authority of the General Committees shall be superior to that of the Department Committees, and their decisions in all matters shall be final and binding, except as hereinafter provided.

OFFICERS.

The General Committee for Employes and the General Committee for Employer shall each elect its respective chairman. The Secretary for the General Committees shall be appointed by the President of the Company, and shall not be entitled to vote. It shall be the duty of the Secretary to keep accurate minutes of meetings of all Committees. For this purpose an Assistant Secretary shall be employed to assist in keeping the minutes and conducting the details of the several Committees.

MEETINGS.

Stated meetings of the General Committees shall be held on the third Tuesday of each month.

Special meetings shall be held at the request of the Chairman of either of the General Committees, submitted in writing to the Secretary.

No less than two-thirds of the members of each General Committee shall constitute a quorum for the transaction of business at any regular or special meeting.

BOARD OF ARBITRATION

If resort to arbitration becomes necessary, then there shall be an arbitrator chosen by the General Committee for Employes and an arbitrator chosen by the General Committee for Employer; the two arbitrators so chosen to select a third arbitrator. Failing unanimous decision, the decision of any two of these arbitrators shall be binding.

In the event that the arbitartors chosen by the General Committee for Employes and the arbitrator chosen by the General Committee for Employer are unable to agree upon a third arbitrator, then

The Provost of the University of Pennsylvania,
The Chairman of the Public Service Commission, and
The President of the Chamber of Commerce

shall be requested to serve as additional arbitrators, or, failing so to do, to appoint their own personal representatives to act as such additional arbitrators. Failing unanimous decision, the decision of any three of these five arbitrators shall be binding.

Compensation

The pay of members of the General Committee for Employes and of all Department Committees for Employes while employed on Committee work shall be paid from the funds of the Co-operative Welfare Association and shall be at the rate received by the respective employes at their regular occupations, and while so employed they shall receive no pay from the Company.

The members of the General Committee for Employer and of all Department Committees for Employer shall receive no compensation from the Association for their services as Committeemen, but shall receive from the Company the continuation of their regular pay as Company employes.

Each arbitrator shall be paid from the funds of the Co-operative Welfare Association, as compensation for his services, an amount to be determined by the General Committees.

All expenses of any character incident to the carrying out of the Co-operative Plan shall be paid out of the funds of the Co-operative Welfare Association—the same being represented in the amount of the dues as paid in from time to time by the members of the Co-operative Welfare Association and in the sum of $10,000 per month paid in by the Company.

Co-operative Welfare

MEMBERSHIP

Membership in the Co-operative Welfare Association is open to employes one year or over in service and over sixteen years of age, without initiation fee; $1.00 per month will be deducted from the pay of each member, and said dues will entitle members to life insurance, sick benefits and pension, as herein provided.

The Company during the period of this Management has paid into the various funds representing sick benefits, pensions, death benefits, and other benefactions, at the rate of approximately $90,000 per annum. Under the Co-operative Plan of 1918 the Company will contribute a lump sum of $10,000 per month to the cost of carrying out the conditions contained therein.

Should the income realized by the payment of $1.00 per month from members and $10,000 per month by the Company be found insufficient to meet the expenditures of the Association, the dues of members will be increased sufficiently to prevent a deficit in the funds of the Association, and no increase in the amount paid by the Company shall be made until the total amount paid monthly by the members equals the $10,000 paid monthly by the Company. Thereafter all increases shall be borne equally by both. The Company, however, will not reduce its minimum payment of $10,000 per month should the present dues of $1.00 per month create a surplus in the funds of the Association.

LIFE INSURANCE.

A Blanket Policy has been issued by the Metropolitan Life Insurance Company, insuring the lives of employes of the Company desiring to avail themselves of this protection through the medium of the Co-operative Welfare Association.

Certificates of Insurance providing for $1,000 life insurance have been delivered into the possession of each member of the Association, to remain in full force and effect so long as the member continues in the employ of the Company and retains membership in the Co-operative Welfare Association.

This replaces the death benefit of $150 formerly paid under the Co-operative Plan of 1911, to which the members contributed 25c per month, and also replaces the $500 given by the Company to dependents of deceased employes who had been over two years in its service.

The Metropolitan Life Insurance Company makes payment of benefits and insurance under its policy direct to the beneficiaries of the members of the Co-operative Welfare Association.

Each certificate of Insurance for $1,000 issued by the Metropolitan Life Insurance Company, under the provisions of the Blanket Policy, entitles the holder, upon leaving the employ of the Company, to re-insure for the same amount with the Insurance Company without medical examination, at rates based upon the member's then attained age. Any such member subsequently returning to the employ will again become eligible for re-insurance under the provisions of this Blanket Policy.

A special feature of this Certificate of Insurance is a provision that in case of total and permanent disability, occurring before the member shall have attained 60 years of age, from causes arising after the issuance of insurance, the insured will be entitled to receive from the Insurance Company the $1,000 covered by the policy in monthly or yearly installments as set forth in the Certificate of Insurance for $1,000 now in the possession of each member of the Association.

SICK BENEFITS.

Sick benefits are payable at the rate of $1.50 per day, commencing with the eighth day's illness, for a period not to exceed 100 days in any consecutive twelve months.

This replaces the former sick relief of $1.00 per day for 100 days in any consecutive twelve months.

PENSIONS.

Pensions of $40.00 per month are payable to incapacitated employes who have reached 65 years of age and have been continuously in the service for 25 years; meritorious cases of long service, but falling short of these requirements, to be given special consideration.

This increases the former pension plan from $20 to $40 per month.

ADMINISTRATION.

The affairs of the Co-operative Welfare Association shall be administered by a Co-operative Council consisting of the combined membership of the two General Committees for Collective Bargaining. The administration of the Co-operative Welfare Association shall be entirely separate and distinct from the function of Collective Bargaining.

The Co-operative Council shall act as Trustees of Insurance for the Co-operative Welfare Association and shall also authorize the expenditures of all moneys, including payment of sick benefits.

The Co-operative Council shall also pass upon the issuance of Insurance Certificates and the validity and merit of all applicants for pensions.

The President of the Co-operative Welfare Association, who shall also act as Chairman of the Co-operative Council, shall be elected annually from the membership of the Association by the majority vote of all the members of the several Department Committees for Employes.

The Chairman of the Board of Directors and the President of the Company shall be the Honorary Chairmen of the Co-operative Council.

The Secretary-Treasurer of the Co-operative Council and the Assistant Secretary-Treasurer shall be appointed by the President of the Company. The Association shall employ such other assistants as may be required.

The Company's Auditing and Treasury Departments are to be placed at the disposal of the Co-operative Council for the purpose of keeping the accounts and safeguarding the funds of the Co-operative Welfare Association.

CO-OPERATIVE PLAN ADOPTED

On August 19, 1918, a personal letter signed by President Mitten and approved by Mr. Stotesbury was mailed to each employe of the Company, together with a booklet containing the provisions of the amended Co-operative Plan, which included life insurance, sick benefits, pensions, wages and representation through the duly elected Committees, as well as a card whereon employes, so desiring, were invited to express their approval of the same.

The response of the employes was prompt and general, and showed such an overwhelming majority in favor of the amended Plan as to insure its immediate success. A second letter was therefore mailed on August 27th to all eligible employes, one year in the service, enclosing an official application card for membership in the Association which provided for certain information required by the Insurance Company not contained in the original card.

The letter explained that a contract had been entered into with the Metropolitan Life Insurance Company, insuring for $1,000 the lives of all who became members of the Association; and also described the various conditions governing the issuance of the Certificates of Insurance.

A further letter was sent to all eligible employes on September 6th, setting forth that under the terms of the contract with the Metropolitan Life Insurance Company the insurance on employes who mailed their application cards before midnight September 15th would become effective when the card was mailed; that insurance on employes who mailed their application cards after midnight September 15th and up to midnight September 30th would become effective when the Certificate was issued, and that any eligible employe who failed to mail his application card before midnight September 30th would not be insurable unless able to perform the duties of his or her position.

All of these communications were mailed to the homes of the employes, so that they could be carefully considered by the employes and the members of their families.

At December 1, 1918, there were 9,073 employes eligible for membership in the new Co-operative Welfare Association, of which number the applications of 8,399, or over 92 per cent, are on file. The deaths, owing to the ravages of the Epidemic Influenza, have been unusually large, and this, together with the withdrawals from service, have reduced the total by 267, leaving a net membership as of December 1st of 8,132.

The applications for continued membership very generally bear the endorsement of the wife, who, in most instances, is named as the beneficiary. The following statement of beneficiaries named in the Certificates of Insurance, as being entitled to receive the $1,000 death benefit is of interest:

	Total Number	Per cent of Total
Wife and Children	6,459	80%
Parents	861	10
Other Relatives	588	7
Estate, etc.	224	3
Total	8,132	100%

Following the overwhelming endorsement of the Plan by the employes of the Company, as evidenced by their applications for membership in the new Co-operative Welfare Association, the General Committee, through its Chairman and Secretary, on October 21, 1918, mailed to all employes a letter outlining the progress of the Welfare work and declaring the Co-operative Plan of 1918 operative and in full effect as of that date.

President Mitten's Letter to the National War Labor Board Transmitting Advance Proofs of the Co-operative Plan of 1918.

November 4, 1918.

Hon. Wm. H. Taft, Frank P. Walsh,
Joint Chairmen, National War Labor Board,
Washington, D. C.

Honorable Sirs:

Following my conversations with your Mr. John J. Kerr Caskie in regard to collective bargaining and co-operative welfare work, I have asked him to hand this letter to you with his report.

The Philadelphia Rapid Transit Company, under the Stotesbury-Mitten Management, has been striving since 1911 to perfect such a plan of co-operation between employes and employer as would secure the maximum of efficiency possible under existing conditions and at the same time take from the employe none of his proper rights and privileges.

The result has thus far been most gratifying, as evidenced by the subject matter in the enclosed printer's proof. Following the hearing of our case before your Honorable Board and the dismissal of the complaint, we at once engaged ourselves in so amending the Co-operative Plan as to, as far as possible, remove the causes of such criticism as seemed at the time in the minds of the members of the National War Labor Board and to provide a system of collective bargaining entirely separate and distinct from our co-operative welfare work. The result of our labors is presented in the printer's proof enclosed.

The necessity of some Plan being provided by which Labor and Capital may so work together after the war as to be able to successfully compete for business in the markets of the world, makes us feel that it is almost a duty on the part of students of labor conditions, as well as that of the practical operator, to give this matter the most careful thought. It is in this realization of the impending gravity of the situation that I am requesting you to give us the benefit of your criticism of the enclosed printer's proof with suggested revisions.

The card of endorsement of the Co-operative Plan and application for membership in the new Co-operative Association was mailed to the employes so as to present the opportunity for examination and decision under influence of the home and counsel of the family. As of October 21st, there were 7,809 employes eligible for membership, of which number the applications of 6,789, or over 86 per cent, are on file.

Should you see fit to endorse this Plan, including the changes which we have discussed with your Mr. Caskie, it would seem desirable that you then supervise the first of our elections for branch committeemen in order that no question could be later raised as to their being conducted in absolute fairness.

Bespeaking your early attention, believe me, sirs,

Yours to command,
(Signed) T. E. MITTEN, President.

REPLY OF THE NATIONAL WAR LABOR BOARD.

National War Labor Board,
Washington, November 9, 1918.

Mr. T. E. Mitten, President,
Philadelphia Rapid Transit Company,
Philadelphia, Pa.

My Dear Sir:

I take pleasure in transmitting herewith the action taken by the National War Labor Board at its session yesterday afternoon, with reference to the plan of collective bargaining which you were good enough to submit to its judgment:

"The National War Labor Board views with great interest the portion of the co-operative plan of the Philadelphia Rapid Transit Company which deals with collective bargaining and regards the general intent and spirit of its provisions as entirely in accord with its own principles as outlined in the proclamation of the President of the United States. The details of the plan, however, such as the number and size of committees and similar items, should be made a matter of mutual agreement between the Company and its employes. Mutual agreement at the outset with regard to the plan to be followed is even more essential than mutual agreement upon any particular adjustment which may follow in due course in the operation of the plan.

"The National War Labor Board is glad to co-operate in the carrying out of the initial elections which may be held in accordance with such mutually agreed upon plan of collective bargaining, and the Secretary of the Board will designate an Examiner to supervise such elections, as requested."

May I express the hope that these new plans may work out most successfully? Believe me,

Yours very truly,
(Signed) W. JETT LAUCK,
Secretary, National War Labor Board.

PRESIDENT MITTEN'S ACKNOWLEDGMENT.

November 21, 1918.

Honorable Wm. H. Taft, Frank P. Walsh,
Joint Chairmen, National War Labor Board,
Washington, D. C.

Honorable Sirs:

I take pleasure in transmitting herewith a copy of a communication dated November 19th, addressed to all concerned and signed by the Chairman and Secretary of the Co-operative Association. At November 15, 1918, there were 8,818 employes eligible for membership, of which number the applications of 8,145, or over 92 per cent, are on file.

The Board of Directors of the Company, reiterating its resolution of August, 1911, has formally approved the Co-operative Plan as amended to include Collective Bargaining as representing the policy of the Stotesbury-Mitten management.

The Plan has now been ordered printed in book form and upon completion a copy will be forwarded to each member of your Honorable Board.

In conclusion I desire to thank your Honorable Body for the extremely helpful service of your Special Examiner, Mr. John J. Kerr Caskie, in formulating the Collective Bargaining features of the Plan as now amended and also, in behalf of both the men and the management, to express appreciation of your endorsement of the Plan. The conditions precedent to your complete endorsement have now been fully met as set forth in the foregoing and in the accompanying resolutions.

Your most respectfully,
(Signed) T. E. MITTEN, President.

APPROVAL BY EMPLOYES.

To all Concerned:

Greetings!

The General Committee of the Co-operative Association, at its regular meeting held this date, by a polled vote of 7 "yea" votes to 0 "nay" votes of the Employe members and of 7 "yea" votes to 0 "nay" votes of the Employer members, unanimously passed the following resolutions approving the amendments to the Co-operative Plan of August, 1911-1918:

WHEREAS, The Co-operative Plan as now amended provides for class and group representation, and a free and independent expression of the voice of employer and employe in collective bargaining, through Branch Committees, Department Committees, and General Committees; in the election of whose membership majority and minority representation is assured, and

WHEREAS, The ultimate means of arbitration provided, in which the "thinking public" secures the final arbitrators through its three essential activities, i. e., Service, Education and Commerce, constitutes a broad, just and sound basis for the settlement aright of all disputes.

Therefore, be it Resolved, That the officially delegated representatives comprising this General Committee at its stated meeting held this date do heartily approve, endorse and adopt the Plan for Collective Bargaining and Co-operative Welfare now presented, and

Be it further Resolved, That it is the voice of this Committee that the present Committeemen be continued under the Plan for Collective Bargaining and Co-operative Welfare for each of their respective depots, stations or divisions, and that elections for their successors be held in due course at the several depots, stations or divisions, from time to time under this Plan, and

Be it further Resolved, That this recommendation be transmitted by the Secretary to the several Department Committees for their ratification.

The several Departmental Committees afterward ratified the action of the General Committee in approving, endorsing and adopting the amended Plan for Collective Bargaining and Co-operative Welfare at meetings held this date. The votes as certified by the respective Chairmen and Secretaries follow:

	Employee Members		Employer Members	
Department	"Yea"	"Nay"	"Yea"	"Nay"
Transportation	22	2	16	0
Rolling Stock and Bldgs	18	0	18	0
Electrical	9	0	9	0
Way	9	0	9	0
General Offices	10	0	10	0
Total Department Committeemen	68	2	62	0

This joint action was taken in compliance with the request of the National War Labor Board as contained in their letter of November 9, 1918. The endorsement of the War Labor Board, following our efforts to prove worthiness, is greatly appreciated by the General Committee, as is also the wonderful results obtained by our membership in combating the ravages of the Epidemic Influenza. The Public, by its deluge of complimentary letters, has shown itself as being not unmindful of your remarkable effort.

C. B. Fairchild, Jr., *Secretary.* F. W. Johnson, *Chairman.*
Philadelphia, November 19, 1918.

I hereby certify that I was present at the meeting of the General Committee under the Co-operative Plan of the Philadelphia Rapid Transit Company on November 19, 1918, and by direct questioning satisfied myself that there was a full understanding and complete approval of the Plan as amended at the suggestion of the Employe members of the Committee.

John J. K. Caskie,
Examiner, National War Labor Board.

November 20, 1918.

A LETTER FROM CHIEF EXAMINER, NATIONAL WAR LABOR BOARD TO THE SECRETARY, DIVISION NO. 477

Mr. Robert M. Kernaghan, December 10, 1918
Secretary, Division No. 477,
1007 Foulkroyd Street,
Philadelphia, Pa.

Dear Sirs:

Answering your inquiry of December the Second, directed to the Honorable Frank P. Walsh and referred to me for attention, permit me to inform you that you have not only been correctly informed by Mr. Caskie that the plan for collective bargaining now being established among the workers of the Philadelphia Rapid Transit Company was endorsed by Mr. Walsh and Mr. Taft, but the entire Board unanimously agreed that the general intent and spirit of its provisions were entirely in accord with its own principles and, by way of co-operating in the carrying out of the initial elections to be held in accordance with such plan of collective bargaining, they directed me to appoint an Examiner to supervise such elections.

The plan of collective bargaining provides for its amendment to meet future conditions and we believe that after giving the same a fair trial it will be found to substantially meet the requirements.

Very truly yours,
(Signed) E. B. WOODS,
Chief Examiner, National War Labor Board.

With reference to the Philadelphia situation and the workings of the "Co-operative plan," I can offer no more typical evidence of real co-operation between the management and the employees than to give you a brief account of the "Welfare" picnic held by the employees of the P. R. T. Co. Wednesday and Thursday of last week and to the dinner given by President Mitten to the Co-operation plan Committeemen, his executive staff and some invited guests, including Mr. Charles E. Elmquist, Chairman of the Federal Electric Railway Commission and D. G. Ainey, Chairman of the State Public Utilities Commission of Pennsylvania, as published in the newspapers in Philadelphia the next morning.

> "The closing feature of the picnic was a dinner, given by President Mitten to all co-operative committeemen, comprising 122 representatives elected by employees and a like number appointed by the company. Others attending were:
>
> "Chairman Charles E. Elmquist of the Federal Electric Railway Commission; Chairman William D. B. Ainey and James S. Benn of the Pennsylvania Public Service Commission, and many prominent financial and business men. Mr. Elmquist came from Washington especially to study the co-operative method employed by the P. R. T.
>
> "In his address, President Mitten talked to employees of his company in a heart-to-heart manner that convinced them of his sincerity. He told them too many workmen all over the

country are demanding greater pay and shorter working hours and that until this is stopped and everyone begins saving, the high cost of living will not come down.

"Many of the P. R. T. men, he said, spend too much money, and until they begin saving they cannot hope for conditions to return to normal. He also announced that the company has arranged to accept savings deposits of its employees at interest, and urged that all of the recent wage increase be deposited and saved.

"We all want to get up in the world, President Mitten said, but no man is ever benefited by anything that is given him unless it be an opportunity. We have given you the opportunity to get the money to start with. It's up to you to save and get worms into the can to go fishing with.

"I have been making some investigations, and I find that workers of today buy more extravagantly than before the war. Don't let us get exaggerated ideas of what our needs are and buy such things as silk shirts when others will do just as well. The man with a savings account feels a good deal better at the end of the week than the man who owes part of his week's pay.

"You men are taking a part in the management of the P. R. T. and you will take a greater part under plans I have in mind, but the man who can't save a dollar is in no position to tell us how to run a street railway. We want to pick the future managers of this system from you men, and we want you to get in shape for the job by managing your own affairs well.

"Let us look over our accounts at the end of every week and see how many things we could have done without, and then, next week, let us see if we can't eliminate some altogether."

Mr. Elmquist said Mitten sounded the keynote, when he said the American people must work more and save.

"The man who asks for more money and less hours, Mr. Elmquist said, is not a true patriot in this hour of need, for we are in the midst of the most acute economic crisis this country has ever faced. Work and thrift is the only thing that will save us, and I believe the P. R. T. and its employees have solved the problem ideally, as far as this city is concerned.

"Commissioner Ainey declared he was amazed at the accomplishments of the co-operative plan of the P. R. T., he felt that the citizens of Philadelphia should be congratulated, that the city can boast of such an organization."

Referring further to the "attitude that the Electric Railways can take as to various means of relief": The suggestions and quotations above are in the nature of measures for permanent relief.

The co-operative plan of the Philadelphia Rapid Transit Co. is termed "a plan for collective bargaining and co-operative welfare" and was first put in operation in 1911 under the Stotesbury-Mitten management. It was adopted by the management in August, 1911, and accepted by a vote of the men in November of the same year. In a statement issued by President T. E. Mitten, "Eight Year Period of the Stotesbury-Mitten Management," February, 1919, he said, in part, the following:

"The P. R. T. Co. was formed in 1902, sixteen years ago, to lease and operate the properties of the 52 underlying companies as a single unit.

"The Market St. El. was completed as a result of the City Contract of 1907 under which the P. R. T. Stockholders finished payment in full for their Capital Stock.

"The Management had been unsuccessful and in 1910 the Company found itself with credit exhausted and with earnings insufficient to longer pay its Fixed Charges and the cost of continued operation.

"The Car Rider, the business interests, and the fair fame of the City were suffering from the strikes of 1910 and preceding years. Labor was threatening a further disturbance. The Car Service was bad, the cars antiquated and almost obsolete.

"Mr. Stotesbury, at the urgent request of Stockholders and of City Government, undertook, as a public duty, the rehabilitation of the system and the Management of the property. The Stotesbury-Mitten Management in 1911 promised to meet the needs of the Car Rider, increase the wages of the Men, and to then pay to the Stockholders such return as could be made possible by good management and co-operative efficiency.

"These advance figures are evidence of what has been accomplished by co-operation between the Men and the Management. Every promise of this Management is herein shown to have been faithfully fulfilled."

Passengers carried increased 70 percent. Fares lowered from average of 4.13 cent per passenger in 1910 to 3.91 cents in 1917 by granting additional free transfers. Wages increased from 23 cents an hour in 1910 to 48 cents in 1918.

Dividends were paid to P. R. T. Stockholders until October, 1916, 2 percent, and 1917 and 1918 on a 5 percent basis.

It will be observed that the co-operative plan has been in the process of development in Philadelphia for a period of nine years, and it must be apparent that such radical reforms cannot be instituted over night.

Under the conditions confronting the majority of the Street Railway properties of today, some immediate method of relief must be substituted to save many of our operating Electric Railway Companies from bankruptcy, and the only way is to increase the income through the medium of increased fares and rates, which must hold until by the introduction of some form of "cost of service" plan and operating economies and other savings the relation between income and expenditures can be stabilized.

The lesson to be learned by the Philadelphia example is that every employe should give a full day's work for a fair day's pay—that maximum wages mean maximum output.

January 5, 1920.

That economy of time, effort and energy is the price of commercial success. That we must not expect to get something for nothing.

Capital and Labor should work together. "United they will stand, divided they must fall." The employee who through a reasonable probation period has proven himself worthy to become a permanent employe, should be taken into the fold and made to feel that he is a real part of the working organization; that he must assume his portion of the burdens and obligations, and if he is to participate in the success and profits, he must also stand his portion of the failures and losses likewise whenever they occur.

Closure

Presented by J. R. Bibbins.

The author is gratified indeed with the definite character of the discussion presented in the complementary papers, especially in the declaration by Mr. Jingal, accountant, that each generation should pay for the property and service used—i.e., "pay-down"; that it should "stand on its own feet," by including as proper elements of the cost of service a suitable depreciation charge or annuity, also that in a liquidation of property or control, the permanent shrinkage due to depreciation should be made up either by a depreciation reserve or some other form of compensatory value. The accountant evidently recognizes the essential nature of historical analyses which are urged by the author and properly emphasizes the extreme value of preserving old records. The "key to the vault" is often the key to the truth.

Mr. Kealy recommends private ownership and operation with comprehensive rather than superficial public control, and a cost-of-service basis which includes the element of depreciation reserve. It is encouraging to see this element of cost recognized by so enlightened a corporate official. However, he asks that the "door of the Past" be closed "requiescat in pace." This might be interpreted as controverting the author's recommendation that the "door" be opened long enough to permit of a historical study of the entire economic range. Upon closer reading, the two recommendations are believed to be to the same end. For after the facts have been determined by such an historical study and used intelligently in formulating a basis or foundation for a resettlement plan, and new contractual obligations are entered into, based upon such knowledge of the past, then is the time for the "door of the past" to be closed. Obviously, nothing can be gained by continually working over old history, in the light of better knowledge today, after a "new deal," and a fair one, has been made. In fact, the existing contractual plan under which the Kansas City Railways Co. is now operating was based upon such a valuation and historical study made at the request of Judge Hook of the U. S. Circuit Court by Mr. Bion J. Arnold with this end in view. Thus long years of litigation and acrimonious discussion were finally brought to a reasonable conclusion through the adoption of this resettlement plan. And thus all parties concerned joined in opening the door of history, ascertaining the facts and closing it again for good, with the net results of the inspection written into a new "treaty" and with a reasonable surety of sympathetic understanding of all the facts involved.

Mr. Weston's contribution suggests rather than outlines interesting fields of accomplishment along the lines of "industrial democracy" and it would be an interesting and valuable addition to his paper if he would describe the principles of the co-operative arrangement in Philadelphia with respect to the relations between Management and Labor. In this connection, the author is reminded of a recent interesting exposition of industrial democracy entitled "Man to Man," by John Leitch—a sympathetic discussion of human relations in industry, which every engineer should read and digest. The writer cites typical industries in which a representative democracy of labor and management had brought success out of previous failure in some 20 odd industries.

If this is the key to future success in the railway industry, the co-operative plan in Philadelphia, in its successful evolution, merits study. Another successful co-operative situation was developed in Denver by the enterprising young manager of the Denver Tramways Company, Mr. Frederick M. Hild.

In a crisis, we grasp at straws. Perhaps the sympathetic understanding of Mr. John Leitch may serve to uphold the hands of the few pioneers who have already blazed the trail in the railway industry.

Mr. Weston apparently deprecates the idea of a depreciation reserve annuity as part of the cost-of-service plan, as contrasted with the recommendations of the author and the other speakers. Of course, all depends upon the life of the franchise, which prompted the author in drawing attention to the destinction between "terminable" and "continuing" investment such as a utility vs. a coal mine. The integrity of an investment ought not to be dependent upon the life of a franchise, but unfortunately it is today, due to the prevailing attitude of the Public, or, more properly, the hostile elements thereof in forcing a new deal whenever the corporation comes into disfavor and some opportunity of punishment is sought. Obviously, the integrity of the enormous investment in utilities must not be jeopardized by public clamor and there is in the last analysis no other way of preventing unwarranted advantage being taken of the investor through the termination of a franchise than by requiring those who use the service to *pay for it in full,* including the unavoidable shrinkage in assets through present accrued depreciation. To defer such validation of assets to the next generation by refusing to admit the evident fact of accrued depreciation, is simply to pass on the burden to a future period when an intelligent understanding of the true facts of the case, with respect to the development losses of the past, may be as difficult to achieve as at the present time.

Only in the case of a continuing or so-called "indeterminate" franchise (which evidently is more in accord with the policy of continuous service), and including a fair purchase clause based upon sound and accepted legislative acts permitting the control and ownership to be vested in the Public whenever this becomes necessary, without serious impairment of the physical property or its operating efficiency, might such depreciation reserve be safely waived and only maturing renewals provided for.

Two of the speakers evidently overlooked the contractual relations entered into between the City of Chicago and its railways, known as the Chicago Traction Plan. In this contractual settlement, unfortunately, no *direct* application of the amortization principle was made, with the result that there undeniably exists in the Chicago capital account certain elements of "agreed value" which under an amortization plan would be gradually retired out of rates, such as provided for in the Kansas City settlement previously referred to. However, it must be said in all fairness that the Chicago Traction Plan was the best of its kind that had been produced up to that time and most students of the local situation will admit that, in bringing to a close a long period of bitter warfare and substituting for an old fashioned and unrelated system of properties, a new up-to-date unified system and equipment, the Chicago Traction Plan has, in the long run, benefited Chicago enormously. In fact, it is difficult to imagine the result of Chicago's failure to accept some such settlement plan. For the Chicago Surface Lines, which in a decade have expanded to cover 1000 miles of system, have undeniably borne the brunt of the lack of further rapid transit facilities which should have been constructed long ago.

Critics of the Chicago Traction Plan, however, all fail to recognize that under this plan over $25,000,000 has been contributed to the public treasury in the form of the "City's share," which the 1907 ordinances permitted to be used for new construction work, commutation of fare, increased wages or other reasonable purposes. This is clever argument, but subverts the facts. If the City's share in profits has any justification, it is obviously along the line of *amortization* and it should be recorded here that the Chicago Traction and Subway Commission positively recommended the consideration of this City fund as an important factor in financing the future service and rapid transit properties. The author's intimate connection with this Commission permits the frank statement that Mr. B. J. Arnold and the other members of the Commission were definitely and unanimously in agreement that this traction fund used for construction purposes (uncapitalized) would automatically correct the principal defect of the 1907 ordinances and in fact bring about in this way the amortization of the intangible values then recognized by the courts in the Chicago Traction Plan, to the lasting advantage of both the Public and the utilities. Public opinion is definitely trending toward the elimination of extraneous burdens upon railway rates in the nature of "franchise trades," but unfortunately, the Chicago traction fund, which is intact, now may and should be relabeled "amortization" without injustice to anybody.

Another speaker, a student of city planning, suggests that utility extensions of questionable revenue producing power should be financed by local district assessment just as any other local improvement. This is eminently good policy and is not novel, although unfortunately it is not yet generally accepted. San Francisco financed its railway tunnels and some of its railway extensions on such a plan. The Ravenswood Elevated extension in Chicago was similarly subsidized to some extent by the district benefited. It is a plan that should receive further recognition.

Finally, as to the use of depreciated value for the basis of rates. Had the author the time to develop to its logical conclusion the theory of the Three Generations introduced in this discussion by the record of past history of the typical untility used for illustration much light could be thrown upon this question—in fact, it may be demonstrated that with a utility which is approaching a heavy period of future renewals, the use of depreciated value today (and the consequent destruction of perhaps one-quarter of the actual investment therein due to accrued depreciation), will result in clear and definite confiscation in the future, irrespective of whether the present deduction is or is not an injustice. This occurs by reason of the "new blood" injected into the physical organism through renewals or replacements. It is believed that no court or commission would willingly validate a condition approaching or involving future confiscation even if its decision as to the "present fair value" refused to recognize the unavoidable shrinkage in value today through the progress of accrued depreciation.

DISCUSSION.

Chairman: Gentlemen, this subject has been presented to us now by four speakers from somewhat different angles, and yet all these bear upon this important subject. We have remaining of our allotted time about thirty minutes, and the subject is open for discussion.

Mr. C. W. Lewis: I would like to ask for a little more information about the lack of correspondence on the return upon increased fares. I understand that the increase in return is not by any means in the same proportion as the increase in fares, but is there any information available as to whether this condition is temporary or permanent? Do you get only forty percent of the increase at first, but does it creep up gradually to 100 percent after the people get over their original grouch? In Chicago the claim was made when the elevated road raised the fare to six cents that they only got sixty percent increase on the extra one cent. There was a differential then of one cent in favor of the surface lines.

Mr. Bibbins: The figures that were mentioned had to be, of course, general in their nature. There is today a very large amount of evidence from the different cities, and, as you can surmise, every local condition affects that ratio. In Chicago we had the diffierential fare effect. I do not know of a case on record where the full rate of increase was obtained for the system as a whole. On certain lines, of course, the full theoretical increase is realized occasionally due to the essential nature of the service rendered. But in the great majority of cases, the net results obtained from a raise in fare of one or two cents have been far below par. And this result is readily explained as the short-haul traffic is discouraged, in proportion to the fare increase.

Mr. Lewis: But the idea I am getting at is this. For instance, a man today might say he wouldn't take a car up to the Dearborn Station, but a month from now he may feel differently about it. The condition may be only temporary.

Mr. Bibbins: It is difficult to draw accurate general conclusions upon this point. But from general indications, the recovery is not very large. In other words, it really is a permanent discouragement of short-riding. Therefore the result is not surprising when one considers that the short-haul traffic is the best revenue producer.

Mr. Lewis: You said that it was forty percent of the business. What do you mean by that?

Mr. Bibbins: The theoretical increase in revenue (from 5 to 7 cents) is 40 percent. But the revenue actually realized may be only 25 percent.

Mr. Lewis: Then that would make the business fall off something like fifty or sixty percent?

Mr. Bibbins: The increase in fares was two cents; but this raise reduced the number of riders to such an extent that about 40 percent of the effect of the raise was lost. Still higher fares would lead to a further discouragement.

Secretary: I think I am safe in saying that in general we have not had sufficient time to observe the real effect of that matter, certainly not here in Chicago. I notice in our audience Colonel Junkersfeld. I am quite sure we would be very glad to have a word from the Colonel.

Colonel Junkersfeld: I was fortunate enough to be in Chicago on business and I determined to hear Mr. Bibbins and meet some of my old friends. There is just one thought that comes to me with regard to the railway situation, as with any other business, that there is a very different condition there today than there was two years ago, and, in the last analysis, it can be reduced down to a few things. You have to get enough income to pay the daily and weekly wage, and if you don't pay your debts you don't get any more credit. That about sums the thing up. The matter of valuation is really of considerably less importance, as I see it, today, than it was a few years ago, because it is a smaller factor in the total cost.

Mr. Stevenson: Whenever the property holders, through their directors, allow the management to make the mistake of allowing depreciation to accrue without being properly provided for, whether it has been in paying unjustified dividends or in foolish venture of one kind or another, that that is their look-out and they should stand it. If I buy a one dollar hat and pay five dollars for it, I have lost four dollars and it is my fault. I don't think the city or the tax payers or the users of the utility or the holders have any responsibility.

In regard to junking old equipment, that is a different process. The owner can hardly be blamed because somebody invents a process of transportation that is so much better than the old process that the property then under usage has to be junked, but, on the other hand, the value of that junk is no longer a risk. It is a fixed value, and its earning rate is absolutely a fixed utility, and should pay four and a half or five percent. The difference between the earning rate on that property as they would figure it as an investment and as to what it is worth on the issue of the bonds to cover the value of that should amortize that in thirty-five years. There is no excuse in Chicago today for the use of eighty or ninety million dollars' worth of material that was junked thirty years ago. The amortization of that loss, even admitting that the consumer should pay for all the loss from obsolescence of equipment, ought to be down to about ten percent of its value now.

There is another situation that has presented itself to me; the question of small towns where lighting service has to be maintained under a franchise which is saddled with an unprofitable street car service; the lighting and other utilities have to pay for the losses of the street car service. But the street car service brings real estate that is out of walking distance into communication with the city and increases the value of that property, and I have studied the question as to whether or not it was feasible to charge these property owners an amount equal to the cost of street car service as a local improvement the same as paving, sewerage, etc., because those property owners are the ones that benefit from it. The land goes up in value and they can use it for residential purposes or for business, just as they choose, purely because of the fact that the street car is there. Yet they pay nothing for this advantage. It seems to me it is a question of local improvements, just the same as better roads or sewers, water supply, etc. I think there ought to be some method of equitable distribution of the cost of that improvement on the property owners to pay the fares, instead of making the future generation, or the people that live closer to town pay the fare for running that line to improve the property of a few. We have a fine example of that right in our own state of Illinois. A few years ago the City limits of East St. Louis were extended to Bellville for a distance about three hundred feet each side of the interurban line, so that the interurban line had to furnish transportation to the factories of East St. Louis, to people living on the properties of people who controlled the City Council at a fare of five cents instead of ten cents, consequently practically doubling the value of their property.

Mr. Lewis: I want to make a few remarks about paying income on junked property, watered stock and all that. I don't think the position of the investor gets fair recognition. There is a statute of limitations in every investment. After it gets to be a certain number of years old it is forgotten and the investor starts over again. There was a good deal of actual hard money put into the stocks ten or fifteen years ago and they were issued in absolute accordance with the accepted practice of that time. There is no reason why there should not be a Statute of Limitations on that. An ordinary investor didn't put his money into something that was a risky venture; he put it into something that was in accordance with the accepted practice of the times. So much for watered stock, etc. I am not advocating any outrageous principle or anything like that.

Now as to the electric light and power company and so on with an unprofitable street car concern saddled on to it, it is a good deal the case of a farmer raising his sheep. It is absolutely impossible for the farmer to say what the sheep is worth and what the wool is worth; he has to sell them both for what he can get. A man living along the end of a street car line has his property increase in value, but so does the property of the merchant that furnishes the man with the merchandise he has to sell. The question must be taken as a whole and rates charged for each part of it, what can be collected, and what people can pay.

Mr. McCullough: Mr. Jirgal referred to an item of replacement and repair. Does he refer to that as one item or two items? If as two items, what is the distinction between repair and replacement?

Mr. Jirgal: Ever since the subject of depreciation has come before the attention of the public service commission there has been the question raised as to where the demarcation was between what is actually provided for by depreciation allowance and what is actually repair. That has been made on a number of bases, but I think for electric railways it is now becoming recognized that no distinctions need be made between the two terms, that an allowance should be made for depreciation and for repairs, that those charges which are obviously repairs should be charged to the allowance as repairs, and those which are not repairs should be charged to the same allowance but recognized as replacements or reconstruction or renewals, or any of the terms that apply to it. There are some items which are clearly repairs, but there is a *twilight zone* where it is hard to distinguish whether a thing is a repair or a replacement or a renewal or a reconstruction or a rehabilitation. The Interstate Commerce Commission has transportation systems so formed now that it allows for two separate depreciation investments one is for depreciation of ways and structures and the other for depreciation of equipment. The policy of most companies is to charge a few of their repair items under the things which are repairs and to charge under the reservation those things which they are not certain are repairs. That is the best knowledge I have on the subject, and I have found it to be followed by a number of street railway companies.

Secretary: Gentlemen, the discussion tonight and the papers that have been presented by these gentlemen have touched upon a very vital situation that is before all of us, and, as engineers, we should bend our best efforts toward a proper solution and a proper understanding.

If there is no further discussion we stand adjourned.

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CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV JANUARY 20, 1920 Number 2

SOUTH PARK BOARD APPROVES STADIUM DESIGN

Structure to Cost $2,500,000

Plans for a huge stadium on the Lake Front, to cost approximately $2,500,000, and to be erected in connection with the Field Museum, have been submitted to and approved by the South Park Commissioners. Six architectural firms engaged in competition, submitting their designs and estimates at the same time. The design submitted by the firm of Holabird and Roche was awarded the prize of $5,000, while the other organizations were awarded $1,000 each.

There will, of course, be many changes in the original specifications but the design as submitted will be followed as far as practicable.

The entire South Park development plan wll be submitted to the voters of Chicago in April, according to present indications. The Secretary of War has given tentative approval of the project, naming several changes in minor details which will be accepted by the Board. Bonds will be issued to finance the proposition should the public approve the

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W. S. E. ANNUAL DINNER

Committee Promises Much

3100 Members Expected to Attend

On January 28th the Western Society of Engineers will officially close the most successful year of its existence and begin one of promise with the annual dinner and meeting at the Hotel Morrison.

This event promises to eclipse our Fiftieth Anniversary Dinner-Reunion, according to meager reports emanating from the committee in charge. A veil of secrecy has been thrown about the actions of this committee, lest some of their well-laid plans for a surprise should come to naught.

A member of the Journal staff called on the chairman of the committee recently, asking for a program and announcements.

"It's going to be at the Morrison," he was told. "A nationally known figure will be the chief speaker. Outside of his address, the only other speeches will be made by retiring President Baldwin and the president-elect. Don't ask what the remainder of the program will contain. All I am at liberty to say is that it's going to be different—and better than any

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GEORGE WESTON

George Weston, M. W. S. E., one of the leading transportation engineers of the United States, and a valuation expert, died at his Philadelphia home after an illness of short duration, January 7, 1920.

Mr. Weston was born in Kalamazoo, Michigan, in 1861, receiving his education in the schools of that city. At the age of 19 he entered the employ of the Missouri, Kansas and Texas Railroad Co. as a rodman on construction work south of Ft. Worth, Tex. In 1882 he entered the mercantile business but again in 1885 he returned to engineering work as a rodman for the Gulf, Colorado and Santa Fe Railroad.

Two years later he was placed in full charge of the Clybourn Avenue, Milwaukee Avenue, Blue Island Avenue and Halsted Street cable lines of the North and West Chicago Street R. R. Mr. Weston also rebuilt about 75 miles of horse car lines on the west side into electric lines.

In 1896 he resigned from the Charles T. Yerkes forces to become manager of the construction department of Naugle, Holcomb & Co., having charge of the building and development of the Suburban Lines of Chicago, the changing from a steam to an electric road of the Chicago Terminal Transfer Company and the construction of the Tennessee Central Railway.

Mr. Weston was associated with his brother, Charles V. Weston, as constructing and consulting engineers during the period from 1901 to 1903, then assumed duties as assistant chief engineer and member of the Board of Supervising Engineers of the Chicago Traction Co. He remained with the board until 1914.

Then Mr. Weston specialized as a transportation engineer and in the valuation of public utilities.

At the time of his death he was engaged in an educational campaign among public utility commissions. Although Mr. Weston's home primarily was in Chicago, he spent the greater part of his time during the last few years of his life in the east, assisting in the rehabilitation of electric transportation lines.

One of his most important works was "Industrial Democracy," a treatise on the relations between capital and labor. Mr. Weston's last paper presented before the Western Society of Engineers, September 8, 1919, on "Electric Railway Policy," appeared in the January 5 issue of the Journal of the Society.

Mr. Weston, besides being a member of the Western Society, held membership in the American Society of Civil Engineers, the American Institute of Electrical Engineers, Engineers' Clubs of Chicago and New York, the Chicago Athletic Club, and was a thirty-second degree Mason.

AWARDED EDISON MEDAL

W. L. R. Emmet, a consulting engineer with the General Electric Company, Schenectady, N. Y., has been awarded the Edison medal for 1919 for meritorious achievement in electrical science, electrical engineering and the electrical arts, it has been announced. Mr. Emmet is a member of the American Institute of Electrical Engineers and is one of the pioneers in the development of electrical propulsion for ships.

W. S. E. ANNUAL DINNER

(*Continued from page* 15)

other annual meeting the Society has had in the past."

However, the staff member did secure a promise that announcements of the program would be sent out in time to give every member of the Society opportunity to make a reservation.

We had six hundred at the December 2nd dinner. Every man who attended that dinner will be at the annual meeting, we feel sure. And the other 2,500 members are going to be there, too. Three thousand one hundred W. S. E. boosters—boosters for the profession and for Chicago.

There will be a detailed announcement of the affair sent to every member of the Western Society. The same plan in vogue at the anniversary dinner will be in effect January 28; that is, members may make reservations at the Society headquarters and secure their tickets the night of the dinner at the Morrison.

Don't forget the date. JANUARY 28, 1920, 6:30 P. M., HOTEL MORRISON. Short, interesting and worth while program.

CONVENTION DATE CHANGED

Because of the impossibility of making suitable arrangements for the annual meeting of the Associated General Contractors of America, to be held in Chicago January 20 and 21, the dates have been advanced one month to February 18 and 19.

The National Conference on Construction is to be held in conjunction with the Annual Meeting of the Association, and the authorities felt that another month used in preparation for the convention would be well spent.

W. A. Rogers for President

The nominating committee has announced a change in the list of nominations. Frederic Cranford of New York, the first nominee, has declined the nomination and W. A. Rogers of Bates and Rogers Construction Co., Chicago, has been chosen to fill the vacancy. Mr. Rogers is a member of the Western Society of Engineers.

Program

A tentative program has been prepared as follows:

The morning session of Wednesday, February 18, will be devoted to a business meeting of the contractors belonging to the association.

That afternon the National Conference on Construction will open. Papers on "The Lump Sum and the Cost Plus Forms of Contract" and "Industrial Relations" will be the principal topics of discussion. This conference is open to members, general contractors, engineers and the public.

The second meeting of the Construction Conference will be held the afternoon of the 19th. Exceedingly interesting papers have been arranged for to be given by nationally prominent speakers. There will be divisions for Building, Highway, Railroad and Public Works Contractors.

Papers to be taken up at the Building Contractors' Meeting are: "The Expense of Estimating," "The National Board of Jurisidictional Awards" and the "Joint Conference Plan with Labor."

Highway contractors will discuss "The 1920 Highway Problem," "State

Highway Contracts" and "Getting Together with the State Highway Department."

Railroad Contractors will hear papers on "The Disposition of the Railroads" and "Reconstructing the Railroads."

"A National Department of Public Works" and "The Budget System" are the papers to be presented to the Public Works' Contractors. Engineering Council is devoting much of its time working for the creation of a Department of Public Works and this section of the program should be of special interest to members of the engineering profession.

The annual banquet of the Association will follow this final session of the conference.

WOOD REPLACES CONCRETE

The present concrete piles, caps and struts of the ruined pier at Santa Monica, California, are to be replaced with creosoted wood piles, timber caps and struts on the recommendation of the engineers in charge of the reconstruction of the pier.

Many of the concrete piles have been practically eaten away by the action of the sea water. The pier has been condemned because of this condition.

The recommendations for the use of creosoted piles instead of concrete are based on the fact that the life of the timber understructure will about equal that of the deck structure there now, thus making the greatest possible use of the original investment consistent with public safety.

GERMANS CONSTRUCT 372 SUBMARINES

The German Imperial Government during the five years of the war constructed 372 submarines, of which only 170 were in commission November 11, 1918. This is based on reports issued recently by the commission for investigating war responsibility.

The aggregate displacement of these under-sea boats was approximately 210,000 tons. They mounted 401 guns, carried 2,314 mines and were manned by a complement of 11,673 officers and men.

It was not until the third year of the war that the 1,000-ton submarine was constructed, the average U-boat displacing about 800 tons at most. Special types, such as submersible cruisers and the "Flanders" boats of a limited cruising radius, were built.

ARMISTICE DEFEATS CONSTRUCTION PROGRAM

On America's entry in the war the seven Deutschlands were converted into fighting craft, the work of transformation being done at Kiel. A month or so before the armistice a huge program of construction was formulated by Admiral Scheer, successor to von Capelle.

Toward the end of the third year of the war, Germany was constructing submarines at the rate of two a week and devoting her attention to the building of large boats, designed to operate thousands of miles from the home base.

Recent cable dispatches from Berlin announce that Dr. H. Techel of the Krupp firm is publishing the details of submarine construction together with engineering data in a technical magazine maintained by one of the large German technical societies.

A. I. E. E. MEETS

The 357th meeting of the American Institute of Electrical Engineers was held in Chicago, January 9 and 10, about two hundred representatives from ten states being present.

The general subject of the program for the meeting was "Electrical Distribution for Street Lighting." Members of the Western Society and the Chicago Section, Illuminating Engineering Society, met with the A. I. E. E.

Friday morning, January 9, was devoted to registration, board and committee meetings. F. L. Hutchinson, national secretary, was present as were the following members of the board: Vice-President C. E. Skinner, Charles Robbins, Charles S. Ruffner, F. F. Fowle, William A. Del Mar, and E. H. Martindale, managers.

In the afternoon two papers were presented by W. P. Hurley, Sales Engineer, Westinghouse Electric and Manufacturing Co., New York, and Ward Harrison, of the Engineering Department of the National Lamp Works, Cleveland. Mr. Hurley's paper was on "Series Systems of Distribution for Street Lighting" and Mr. Harrison took up "Multiple Systems of Distribution for Street Lighting." Both papers are printed in the January number of the Institute Journal.

Dinner was held that evening at the City Club after which the guests were addressed on "Constant Potential-Series Distribution for Street Lighting," by Dr. Charles P. Steinmetz of the General Electric Co.

Saturday was spent in inspection trips of various distribution stations in the city.

MONTHLY LUNCHEONS

By F. G. Vent

The Entertainment Committee is planning to start noon luncheons of the Western Society, Friday, February 20. The committee is not prepared at present to announce the speaker for that day. However, watch this section of the Journal each two weeks as there will be important announcements of social functions of the Society.

Responses to the questionnaires at the fiftieth anniversary dinner were unanimous in their approval of these luncheons.

Special attention will be paid to excursions this year. In fact, division of the Entertainment and Excursion Committee into two units is being considered because of the enlarged program decided upon.

Address any suggestions that you may have to offer for entertainment to the Chairman, Entertainment and Excursion Committee.

A. S. M. E.

The next regular meeting of the Chicago Section, American Society of Mechanical Engineers, will be held January 23 in the Hotel Morrison at 6:30 p. m. Dinner, $1.50 per plate.

W. F. Parish, former chief of the lubrication department of the aircraft service, U. S. A., will deliver an address on "Some New Lubrication and Fuel Problems."

Members of the Western Society are invited to attend the meetings of the Chicago Chapter. Arrangements for reservations for dinner should be made through Mr. A. L. Rice, 537 South Dearborn Street, or Mr. G. R. Brandon, 347 Monadnock Block, chairman and secretary of the section, respectively.

W. S. BIDLE TO ADDRESS AMERICAN STEEL TREATERS

The February meeting of the Chicago Chapter, American Steel Treater's Society, will be held at the City Club, Tuesday the 10th.

Mr. W. S. Bidle of Cleveland, Ohio, will present a paper before the society on "The Mechanical Side of Steel Treating." Mr. Bidle has had twenty-five years experience in this business and his paper should be of more than ordinary interest and also authoritative.

The Chicago Chapter announces that the meeting is open to all that may be interested in the subject. It is the custom of the organization to precede the paper of the evening with a dinner at 6:30, the tariff being $1.50, the meeting proper beginning at 8 o'clock. Those not desiring to attend the dinner are urged to attend the meeting later.

The officers of the Chicago Chapter are:

H. H. Clark, a member of the Western Society, chairman; Prof. P. C. Huntly, Armour Institute, vice-chairman; C. W. Schumann, Mechanical Engineer, secretary-treasurer, and P. A. Lovegren and T. W. Hamerly, members of the Executive Committee.

ELECT OFFICERS

At its last meeting the Swedish Engineers' Society of Chicago elected the following officers for 1920:

President—C. G. Axell.

Vice-President—John S. Gullborg.

Secretary—C. H. Mayer.

Treasurer—Axel K. Sjolander.

Board of Diretcors—John E. Ericsson, John Brunner, C. S. Ongman, John Ericson, and Klas Olson.

SOUTH PARK BOARD APPROVES STADIUM DESIGN

(*Continued from page* 15)

project when it is submitted to them for decision.

Under the proposed arrangement, 100,000 people can be accommodated in the stands at times when pageants, military reviews, athletic contests and great public gatherings are held.

In preparing the design for the stadium, two requirements were considered of paramount importance:

(1) That the proposed stadium should in no way conflict with the Field Museum.

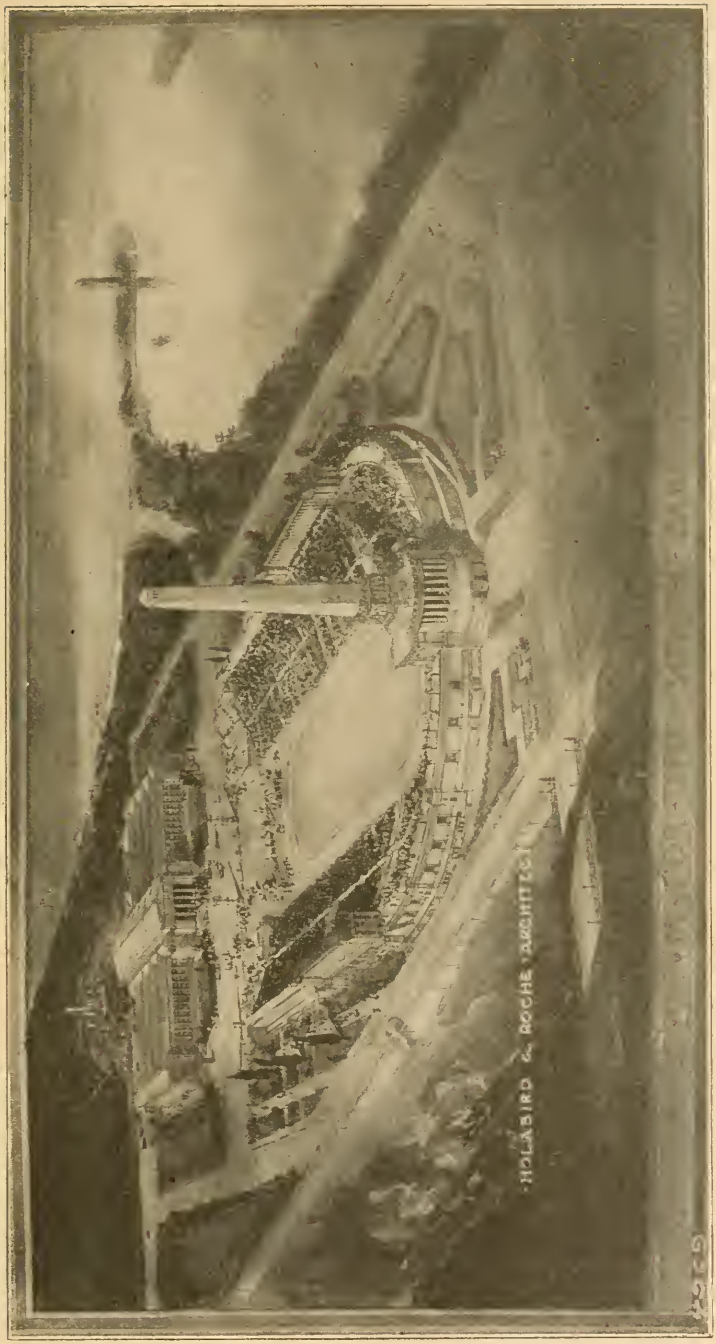
(2) That the majority of the permanent seats should be concentrated around a comparatively small area to afford to the greatest number the most advantageous view of events.

The architects worked on the assumption that the Field Museum should be considered the head of the composition, the axis of the stadium being the same as that of the Museum. The north end of the arena is left entirely open, affording to each spectator an unobstructed view of the Museum.

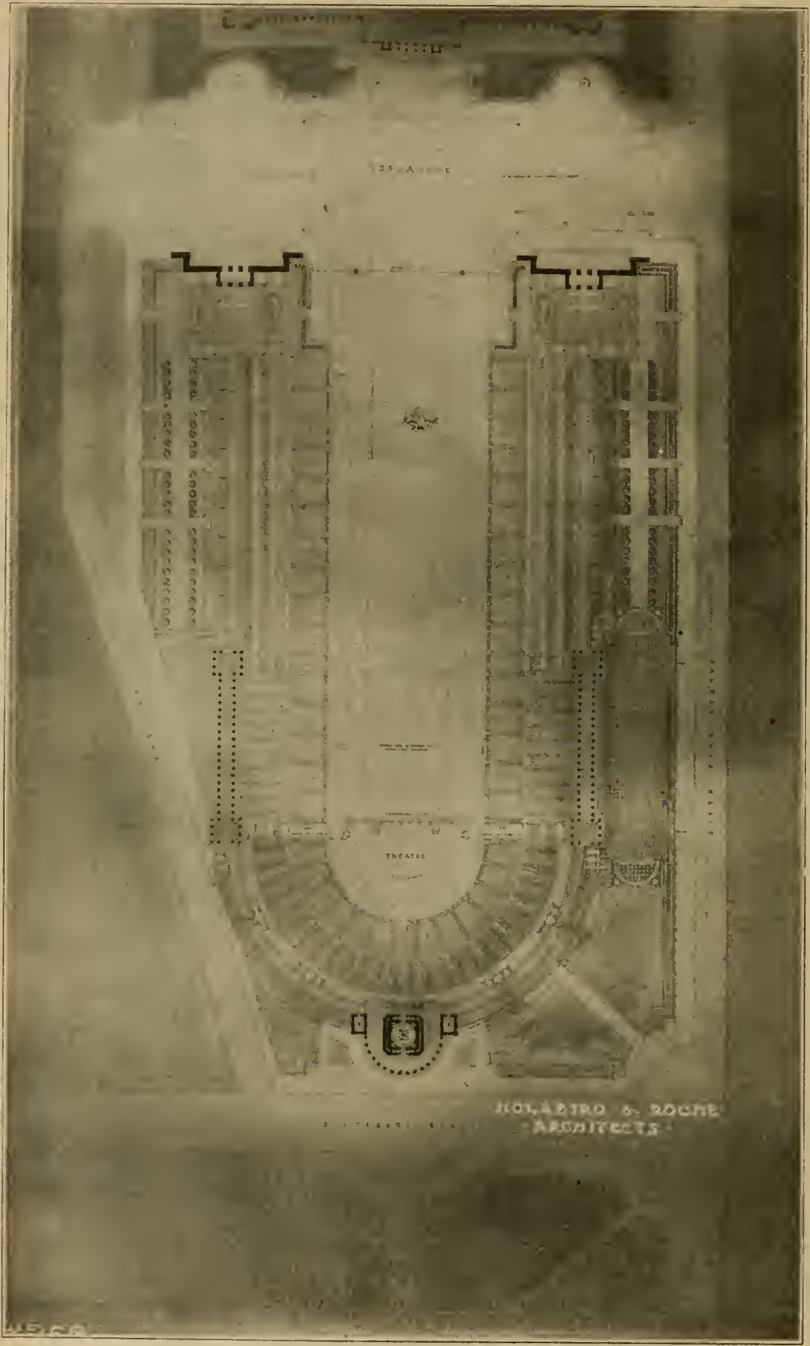
North from the east and west porticoes, the permanent seats are entirely below grade 31, which is the grade of the esplanade in front of the Museum. In this north sector, the structure is a series of terraces finishing opposite the end pavilions of the Museum in simple sculptured walls and stairways. Conflict with the architecture of the Museum is entirely avoided by this arrangement.

The arena is 300 feet between walls, being made as narrow as practicable, at the same time placing the spectators as close to the enclosure as deemed advisable.

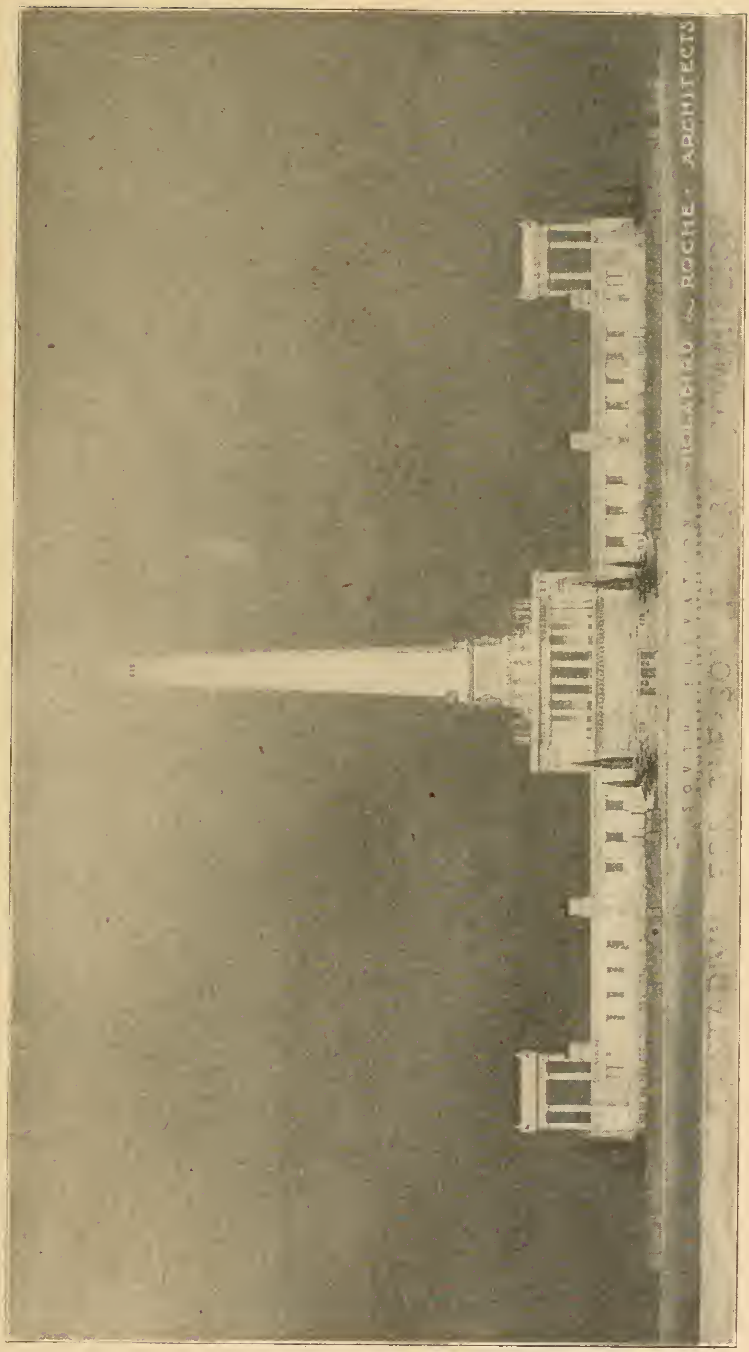
The stands of most importance are those on the east and west sides of



Proposed Lake Front Stadium



Plan Showing Seating Arrangement



South Elevation of Proposed Stadium

the structure. A football field is centered on the center line of these stands and the finish of the one-third mile track and the 220 yard straightway is opposite the reviewing stand at the center of the west group of seats. The combination of the east and west stands with the theatre seats—those in the semi-circle at the south end—comprise the large majority of permanent seats, about 50,000 in number.

In order to concentrate the seats around a small area, it was found necessary to extend the height of the stands above the grade 40. The spectators are thereby afforded a better view of the entire arena and this arrangement permits the north sector to be kept at such a low elevation that there is no conflict with the Field Museum.

As will be noted in the accompanying illustrations, the surface of the amphitheatre is slightly bowled, in order to give the proper lines of sight and at the same time keep the stands as low as practicable.

The 60,000 permanent seats include the main east and west stands, full height, the theatre except the upper terraces, and, in the section north of the main stands, the seating below grade 31.

Forty thousand temporary seats are provided for in the upper theatre terraces, the three terraces north of the main east and west stands and a portion of the north end of the arena.

The full 100,000 seats surround the stadium uniformly to the top promenade. Terraces form bases for the temporary seats and by the arrangement the seating capacity becomes flexible, inasmuch as any number of terraces may be filled with seats, leaving a finished structure in the event they are not all used. The terraces may also be used for standing room, thus accommodating a greater number of people than it would be possible to handle if seats were employed.

A promenade extends at grade 31 entirely around the stadium, from which at suitable intervals extend passageways and ramps leading to the banks of seats. People may enter at the north end or at any of the terrace levels and proceed to the section of seats which they are seeking. Entrances are provided for on the exterior of the stadium as well. Stairways furnish direct access to the upper promenades. All the main aisles in the amphitheatre lead directly to the arena.

Pageants or large bodies of troops would enter at the north, pass south by the west reviewing stand, circle the theatre and then proceed out along the east reviewing stand. There is no limit to the number of troops or size of pageants that may be reviewed in the stadium.

The superstructure comprises a wide promenade, covered on the east and west by two monumental porticoes. Along this promenade sockets are provided for the display of flags and bunting. Provisions are made for setting up searchlights at the south end.

At the extreme south end it is proposed to erect a large monument commemorative of the men from Chicago who lost their lives in the Great War. The site is of such a commanding nature, with the 1,500 foot sweep to the Field Museum that it is highly desirable that a monument worthy of Chicago's effort in the war, in men, time, money and energy, should be placed here. The monument shown in the design was not called for in the competition and had no bearing on the decision of the Board. This portion of the design has not been accepted by the Board but it is expected that a suitable architectural feature will be placed in this position.

In the space under the main stands, east and west, and under the theatre, arches have been used in order to eliminate columns and give large, unobstructed areas. This space is divided into three large halls having approximately 125,000 feet of floor area, available for automobile, live stock, dairy, industrial or other educational exhibitions. Several permanent exhibitions are now being considered.

In the event that the park east of the project is developed in connection with the stadium, portions of the space under the stands would be used for shops along the boulevard face of the structure.

Parking space for automobiles and other vehicles is arranged for in the long triangle south of the site of the arena. The stadium will be constructed entirely of masonry.

It is planned to devote several meetings of the Western Society to the discussion of the South Park Board's plans, of which the stadium is an important feature.

ENGINEERING COUNCIL APPEALS FOR FUNDS

Some time ago Engineering Council sent out an appeal for funds to 50,000 engineers.

The Council needs not less than $45,000 for 1920, and of this sum at least $30,000 must come from general contributions, Alfred D. Flinn, secretary, says, in an announcement sent out recently.

A budget for income and expenditures for 1920 has been prepared as follows:

INCOME

From four Founder Societies	$12,000
From other Member Societies	3,000
From General Contributions	30,000
Total	$45,000

PROPOSED EXPENDITURES

New York office, salaries, postage, printing, travel and general expenses	$12,000
Washington office, similar items	12,000
Committee on Classification and Compensation of Engineers	10,000
Other Committees	5,000
Contingencies	6,000
Total	$45,000

The total income of Engineering Council for 1919 was $50,000, including $25,000 advanced by Chairman Channing, not yet repaid.

EXPENDITURES FOR 1919

New York office	$ 7,500
Appeals for funds for 1920	2,000
Engineering Societies' Employment Bureau	13,500
Washington office (including promotion of National Department of Public Works)	25,000
Committee on Licensing Engineers	1,000
Committee on Classification and Compensation of Engineers and other Committees	1,000
Total	$50,000

Those desiring to contribute moral and financial support to Engineering Council, should send all contributions to United Engineering Society, 29 West 39th Street, New York City.

JOURNAL
OF THE
WESTERN SOCIETY
OF
ENGINEERS

"To promote and advance the science and art of engineering."

BOARD OF DIRECTION MEETS

The regular meeting of the Board of Direction occurred January 12, 1920.

The Secretary reported the following applications received since the last meeting:

1706 K. S. Baetzmann, Chicago.
1953 Fred T. Whiting, Chicago.
2012 O. W. Regester, Chicago.
2072 R. L. McLellan, Chicago.
2090 Eugene A. Anderson, Evanston.
2091 Walter E. Peterson, Chicago.

Reports of the treasurer and finance committee were accepted.

On recommendation of membership committee the following were elected to membership in the Society:

165 Warner, R. C., Member.
180 Felt, Dorr E., Member.
191 Thompson, Edgar B., Member.
212 Wishart, J. F., Affiliate.
216 Ward, H. L., Associate.
246 Hartz, W. H., Member.
267 Linde, Carl L., Member.
291 Stephens, B. H., Member.
292 Shimmin, R. P., Member.
313 Thompson, A. A., Member.
419 Krahl, William F., Member.
421 Nordgren, George A., Associate.
425 Potter, John C., Member.
518 Douglas, Courtney C., Member.
541 Heath, Chester S., Member.
558 Beach, William E., Associate.
563 Schreiber, Geo. F., Member.
587 Michod, C. L., Member.
595 Gazda, A. A., Associate.
611 Ford, James S., Member.
662 Sullivan, J. Butler, Associate.
698 Lininger, C. R., Member.
722 Mesick, Kenneth S., Junior.
790 Blanding, George H., Associate.
791 Carr, Dean O., Member.
799 Black, James B., Member.
843 Hill, Cyrus G., Associate.
859 Miller, Clarence E., Associate.
877 DePuy, Clarence E., Member.
915 Yost, Verne W., Associate.
940 Hughes, L. J., Member.
957 Hejda, Charles W., Member.
961 Mottier, C. H., Member.
1009 Webb, Edwin W., Member.
1027 Lewis, Edward R., Member.
1036 Brightly, H. S., Member.
1037 Skeen, D. H., Member.
1060 Rawstorns, C. D., Member.
1062 Christian, Wm. A., Member.
1085 Sloggett, L. O., Member.
1090 Slack, Ernest F., Associate.
1227 Taylor, J. Hall, Member.
1243 Silander, A. I., Member.
1248 Morrison, Montford, Member.
1255 Stewart, Walter M., Member
1263 Elman, Louis, Associate.
1289 Reynolds, H. A., Associate.
1313 Blaess, A. F., Member.
1318 Steiner, Seth J., Associate.
1321 Cronican, W. P., Member.
1323 Bryon, C. G., Member.
1332 Robbins, O. B., Member.
1357 Clemens, S. P., Associate.
1365 Taylor, O. H., Member.
1398 Strait, Edward N., Member.
1401 Curd, William C., Member.
1420 Borman, Philip Kingsley, Junior.
1427 Rodgers, G. A., Member.
1428 Fugard, J. R., Member.
1443 Hill, B. V., Member.
1483 Cook, Clare C., Associate.
1487 Boehmer, Alex. H., Member.
1502 Farnsworth, Mark H., Member.
1586 Rogers, Frank Griffith. Member.
1588 Dixon, Edward, Member.
1615 Hans, Walter R., Member.
1631 Corkran, Wilbur S., Member.
1641 Rose, George E., Member.
1643 Van Nostrand, H. G., Affiliate.
1663 Douglas, Wm. A., Student.
1730 Exton, Alfred H., Member.
1731 Black, E. S., Member.
1768 Spitzglass, Jacob M., Member.
1829 Wilkinson, Walter T., Associate (Transfer).
1849 Pifer, Charles W., Member.
1886 Batchelder, W. O., Member.
1899 Carey James L., Member.
1910 Dobbs, Oscar, Associate.
1976 Kirk, Geo. H., Member.
2063 Matteson, Victor A., Member.

Mr. Howson, chairman of the Development Committee, recommended that a committee be appointed to consider and recommend to the Board of Direction, subjects or classes of work to be undertaken by the various committees of the Society. This report was approved.

The president was authorized to appoint a committee to draw up a memorial for Mr. George Weston, M. W. S. E., who died January 7.

The resignation of Mr. N. D. Frazer was accepted.

The Board engaged in informal discussion with regard to Amendments to the constitution, in view of the enlarged membership of the Western Society.

EDGAR S. NETHERCUT,
Secretary.

You're Welcome Here

Members of the Western Society of Engineers will be welcomed by the following engineering societies and clubs at their reading rooms, libraries, and meetings:

American Society of Civil Engineers, 33 W. 39th St., New York, N. Y.

American Society of Mechanical Engineers, 29 W. 39th St., New York, N. Y.

American Institute of Electrical Engineers, 33 W. 39th St., New York, N. Y.

American Institute of Mining Engineers, 29 W. 39th St., New York, N. Y.

Boston Society of Civil Engineers, 715 Tremont Temple, Boston, Mass.

Brooklyn Engineers' Club, 117 Remsen St., Brooklyn, N. Y.

Canadian Society of Civil Engineers, 176 Mansfield St., Montreal, Quebec.

Civil Engineers' Society of St. Paul, Public Library Bldg., St. Paul, Minn.

Cleveland Engineering Society, Chamber of Commerce Bldg., Cleveland, Ohio.

Connecticut Society of Civil Engineers, New Haven, Conn.

Detroit Engineering Society, 127 Franklin St., Detroit, Mich.

Engineering Association of New South Wales, Sydney, Australia.

Engineering Association of Nashville, Commercial Club Bldg., Nashville, Tenn.

Engineers' Club of Baltimore, 4-6 West Eager St., Baltimore, Md.

Engineers' Club of Dayton, Mounment and Jefferson Sts., Dayton, Ohio.

Engineers' Club of Philadelphia, 1317 Spruce St.; Philadelphia, Pa.

Engineers' Club of Kansas City, 910 Grand Ave., Kansas City, Mo.

Engineers' Club of St. Louis, 3817 Olive St., St. Louis, Mo.

Engineers' Club of Toronto, 96 King St., West Toronto, Ontario, Canada.

Engineers' Society of Pennsylvania, 31 S. Front St., Harrisburg, Pa.

Engineers' Society of Northeastern Pennsylvania, 415 N. Washington Ave., Scranton, Pa.

Engineers' Society of Western New York, 801 Chamber of Commerce, Buffalo, N. Y.

Engineers' Society of Western Pennsylvania, Union Arcade, Pittsburgh, Pa.

Enineering Society of York, Pa., c/o S. Morgan Smith Co., York, Pa.

Idaho Society of Engineers, Boise, Idaho.

Kansas Engineering Society, Topeka, Kan.

Louisiana Engineering Society, State Museum Bldg., New Orleans, La.

Maine Society of Civil Engineers, Bangor, Maine.

Montana Society of Engineers, Butte, Mont.

Pacific Northwest Society of Engineers, Arctic Bldg., Seattle, Wash.

Rochester Engineering Society, Sibley Block, Rochester, N. Y.

Technology Club of Syracuse, Syracuse, N. Y.

Technical Society of the Pacific Coast, San Francisco, Cal.

EMPLOYMENT SERVICE

NO CHARGE is made for opportunities announced in this section of the Journal.

ANNOUNCEMENTS must not be more than sixty-five words in length and will not be inserted more than twice during a period of two months, during which time all records will remain in the active files. All correspondence will be treated confidentially.

APPLICANTS for situations, not members of the W. S. E., must have card of introduction from a member of the Society.

ALL REPLIES should be addressed to the key number indicated, in care of Employment Bureau, Western Society of Engineers, 1735 *Monadnock Block, Chicago.*

SITUATIONS WANTED

ENGINEER desires position with railway supply house. References furnished. Address 111.

YOUNG MAN, 3½ years mechanical draftsman, wants position for machine designing. Salary $140. Address 113.

MARINE ENGINEER, 25, married, desires position with marine transportation company. Location no object. Salary $125. Address 108.

GRAD. RY. ELECT. ENGR., 11 years experience elect. and mech. construction; age 33, single; salary $3,000. Capt. U. S. A. 2½ years. Address 109.

GRAD. U. S. NAVAL ACADEMY, 12 years experience, desires position in operating or sales department of manufacturing concern. Address 11-1.

GRADUATE M. E., age 40, married, desires position as factory superintendent or production engineer. Now in employ of U. S. government. Address 104.

GRAD. C. E. desires position with commercial concern where technical training is of value. Experienced as sales engineer. References on application. Address 1-3.

GRADUATE ELECT. ENGR., age 27, married, wants position as power plant engineer or work in connection with industrial plants. Salary $300. Address 107.

GRADUATE CRANE TECH., age 24, single, desires situation with industrial concern, contractor or consulting engineer; salary considered secondary. Address 106.

CIVIL ENGINEER, eight years experience, wants position as construction superintendent or inspector. Age 31, single. Salary $200 to $250 per month. Address 103.

GRAD. M. E., four years experience, desires position where executive ability is required, eventually leading to executive responsibilities. Salary $2,600 to $3,000. Address 110.

STRUCTURAL ENGINEER, 10 years experience, wants position with architectural organization. References furnished. Salary $225. Western or northern states considered. Address 11-5.

GRAD. C. E., married, ten years experience editorial and construction work, wants position as editor of construction paper, manager concrete products shop or construction expediter. Address 112.

GRADUATE C. E., four years experience R. R. maintenance and construction work. Desires permanent position in engineering research or with organization producing commercial product requiring engineering services. Address 11-30.

CAPTAIN ENGINEERS, GRADUATE M. E., five years consulting and contracting engineer, wants executive position. Age 40. Salary expected, $5,000. References on application. Address 102.

GRAD. C. E., qualified for responsible charge of general engineering work, reports and contracts in power plant development; wants position February 1. Salary $4,000. Twelve years experience. Address 12-16.

EXPERIENCED DRAFTSMAN and asst. engineer wants to locate with firm desiring capable office executive for drafting room. Extensive experience in valuation work. Temporary position considered. Address 12-11.

GRADUATE C. E., twelve years experience in design, detail and estimates for bridge and building structures of steel and reinforced concrete, wants position as superintendent of construction. Age 32, married. Salary $250 to $300 per month. Address 105.

U. OF ILLINOIS NEEDS ENGINEERS

The University of Illinois needs men for the research graduate assistantships maintained by the Engineering Experiment Station of the school. Eight vacancies must be filled at the close of the current academic year.

"In view of the present conditions which exist in this country and of the inadequacy of the stipend, we have had great difficulty in securing competent men for these positions, and I fear that our research activities may be seriously impaired at a time when there is a greater demand than ever before for exact knowledge and for men who have had training in research work. I hope that we may be able to secure a small increase in the stipend for these assistantships, but this may not be possible for the next academic year," says Dean C. R. Richards.

Fourteen assistantships are maintained, each with an annual stipend of $500 and freedom from all fees with the exception of matriculation and diploma fees. They are open to graduates of approved American and foreign universities and technical schools who are prepared to undertake graduate study in engineering, physics or applied chemistry.

An appointment is made and must be accepted for two consecutive collegiate years, at the expiration of which period, if all requirements have been met, the degree of Master of Science will be conferred. Not more than half of the time of a research graduate assistant is required in connection with the work of the department to which he is assigned, the remainder being available for graduate study.

Nominations for these positions, accompanied by assignments to special departments of the engineering experiment station are made from applications received by the director of the station each year, not later than the first day of March. The nominations are made by the executive staff of the station, subject to the approval of the president of the university. Nominations are based on the character, scholastic attainments and promise of success in the principal line of study or research to which the candidate proposes to devote himself. Preference is given those applicants who have had some practical engineering experience following the completion of their undergraduate work. Appointments are made in the spring and they become effective the first day of the following September. Vacancies may be filled by similar nominations and appointments at other times.

There may be younger members of the Western Society, particularly those who hold student memberships, to whom this call of the University will especially appeal. The work of the Engineering Experiment Station is closely related to that of the College of Engineering, and the Heads of Departments in the College constitute the Executive Staff of the Station.

All communications in regard to these graduate assistantships should be addressed to the Director, Engineering Experiment Station, University of Illinois, Urbana, Ill.

PROPOSED CLASSIFICATION OF ENGINEERS APPROVED

Complete and definite classification of engineers in federal, state, county, municipal and railroad service was approved by Engineering Council on December 18, 1919, when the report of the Committee of Classification and Compensation of Engineers was approved.

In the report eight grades are defined, five professional and three sub-professional, and the necessary qualifications are specified.

Extracts of the report may be obtained from Engineering Council on application.

The committee found in its investigation that there was (1) an absence of any uniform system of grading of positions, (2) a lack of uniformity in titles of positions with respect to duties, (3) inequalities in compensation for positions of the same grade, and (4) generally inadequate compensation for service rendered.

To correct these conditions the committee recommended that:

1. Positions should be classified in accordance with the type of work, and with the character of the duties to be performed and with the qualifications necessary for their performance, as indicated by a system of grading.

2. Within the salary limits fixed for each grade, there should be a system of advancement through the grade based upon experience gained in the position and upon proof of increase in the proficiency of the employe in performing the duties of the grade.

3. Promotions from grade to grade should depend upon existence of a vacancy in the higher rank and proof that the employe is qualified to fill the vacancy.

4. The determination of salary adequate to procure for and retain in engineering work a high class of employes, should take into account and properly weigh the following considerations:

(a) The capital invested, both in money and in time, in obtaining the requisite fundamental training.

(b) The amount and character of experience and the degree of personal ability required.

(c) The relative value of the classes of work to be performed.

(d) The amount paid for similar service in other lines of work.

(e) The amount necessary to enable the employe to maintain a standard of living commensurate with the general standards of the community for positions of similar dignity and responsibility.

5. In the interest of an adequate social policy, no position likely to be occupied by individuals of an age to assume family responsibilities should fail to pay an amount sufficient to permit the maintenance of the average family in reasonable decency and comfort.

6. In the interest of the employes as a whole and of the employer, a system should be established by which employes who fail to maintain satisfactory standards of service should be removed, transferred, demoted or retired as may be equitable in the circumstances.

A national forest policy which shall concern itself largely with conservation, particularly from fire losses, and with a scientific method of public reforestation is urgently needed, but the belief that timber is scarce and that there is not a sufficient supply for building and other purposes is erroneous, the National Lumber Manufacturers' Association says.

Some stocks are low, it is true, and production during the year has been held down by high operating and labor costs and in some sections, by unfavorable weather, but the timber supply of the country is far from exhausted and there is no reason on this ground for advocating the use of substitutes.

THE DEPARTMENT IDEA IN MANUFACTURING

When one stops to analyze the organizations of any of our great industries today, the extent to which specialized knowledge has been responsible for their tremendous development. can be appreciated.

The plant which today is considered of pretentious size has long since outgrown one building. Very often it can best be described as a huge assembly room, surrounded by separate departments each contributing its particular product or performing its special function, as a distinct and yet co-ordinated unit of one organization. And not only have these departments of specialized work developed within one plant but very frequently it has been found advisable to distribute the various contributing departments over a wider field, and for various reasons. Sometimes the supply of labor, material or fuel may advise the location of a unit many miles from the central plant. And where transportation facilities are available, distance has ceased to be a matter of really great importance.

Nor is this all. For in many instances departments, so called, have in themselves become separate and distinct industries, due to the fact that men have conceived of possibilities in the adaptability of a product which could never be realized where limited opportunity only is afforded.

These might be designated today as "Contributing Industries" because in a way they are dependent on the parent industry inasmuch as their products are not intended for independent use. And in many instances the so-called parent industry or organization has come to depend on these separate industries as their own special departments from which they draw as need requires for the assembly of a complete product.

The automobile industry may be used as an example. It is well known that in many instances the manufacturers of a car design the chassis and then turn to these contributing industries sometimes for motors, sometimes for bearings or axles or wheels. Bodies, tops and many other parts might be mentioned as coming from outside departments. And perhaps none of these departments or separate industries have won a more pronounced recognition than the pressed steel industry whose products fulfill not one particular function today but have rapidly developed a wide and ever increasing application wherever steel may be used.

There is every reason why this one time department should have grown to a separate industry, because essential as pressed steel parts have become, the elaborate facilities for their production represent an outlay unwarranted in nearly every instance by individual requirements.

When one estimates the millions invested by manufacturers of bearings, springs, axles, wheels, etc. (to say nothing of tires), the immensity of the development of contributing industries—really special departments for the great parent automotive industry—is almost staggering.

And there can be no question but that the growth of these specialized industries has resulted because their existence and operation fits into the economic scheme of production. If this were not so, great organizations with available capital would cease to draw their supplies from these outside departments.

Not only from the economical standpoint but because this arrangement distributes responsibility and opportunity and thereby stimulates initiative is it desirable as a condition.

The labor situation is so much better now, says a prominent New York analyst of business conditions, that we may look for an early revival of production, probably reaching the normal line in January and getting well above normal before the spring of 1920, so that the shortage of goods is probably at its height now. Real relief is not likely to be seen much before the middle of the year.

COAL PRODUCTION FOR 1919

Preliminary estimates issued by the U. S. Geological Survey indicate that production of Pennsylvania anthracite and bituminous coal last year was approximately one hundred million tons below the amount produced in 1918. The report which is based on figures obtained from the Anthracite Bureau of Information and the U. S. Railroad Administration, shows that 544,263,000 tons were produced in 1919 against 678,212,000 tons in 1918.

This slump is due to the prolonged coal strike and also to the fact that in 1918 miners and owners labored under the emergency of war. Production in 1918 is the largest that has been recorded since 1913, the report indicates.

YEAR BOOK

To be worth while the Year Book of the Western Society of Engineers should contain an accurate list of the names and addresses of the members of the organization. This can be accomplished only by careful compliance with the regulations of the Society in forwarding to the secretary all changes of address and occupation.

Prompt notification is an assurance that all mail will reach you on time and in good form and may may save you some embarrassment when the year book is published.

FINANCIAL COMMANDMENTS

1. WORK AND EARN to help increase the world's goods and decrease the cost of living.

2. MAKE A BUDGET to ascertain how you should dispose of your income.

3. KEEP A RECORD OF EXPENDITURES to see how close you come to your estimates.

4. HAVE A BANK ACCOUNT to keep your money in a safe place and to help you save.

5. CARRY LIFE INSURANCE to protect your loved ones in case of your death.

6. MAKE A WILL to help insure your resources going quickly to those you desire to receive them.

7. OWN YOUR OWN HOME to secure the greatest satisfaction in your home life.

8. PAY YOUR BILLS promptly to meet the moral obligation you have to your creditors.

9. INVEST IN GOVERNMENT SECURITIES to help your country and to make a wise investment.

10. SHARE WITH OTHERS to fulfill your religious duty of stewardship.

TECHNICAL SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV. JANUARY 20, 1920 Number 2

City Zoning*

By Robert H. Whitten,
Advisor, Cleveland City Plan Commission.

Presented September 30, 1919.

A BUILDING zone plan is an essential part of the city plan. The city plan includes all permanent physical elements of the city structure. The rail and water terminals furnish the basis of city growth; the streets form the framework of the city structure, and the buildings erected along the streets complete the city structure. Unless all parts of the city structure are built in accordance with a well considered plan, the city is likely to be inefficient and less desirable either as a place in which to live, to work, or to do business. Haphazard development is usually costly and inefficient development. It is plain common sense to have a plan before starting to build. City building is no exception to the rule.

In addition to a building zone plan, a comprehensive plan of city building includes a plan of rail and water terminals, a street and thoroughfare plan, a water supply and sewage disposal plan, an urban transit plan and park and recreation plan. All of these plans are in large measure interdependent. They must all be worked out in harmony. As a practical matter, it is seldom feasible to work out all parts of all plans at the same time. This makes it necessary, in a building zone plan, for example, to leave certain parts of the plan tentative or open for future determination when other phases of the city plan have been more fully worked out.

Especially important in the determination of a building zone plan are the plans for rail and water terminals, for main thoroughfares and for urban transit. The planning of these features should be well advanced before a building zone plan is adopted.

Zoning is designed to direct the building development along well-considered lines of city growth. It substitutes orderly development for haphazard and ill-considered development. With or without a zoning plan, there is bound to be a more or less natural division of the city into districts of different occupation, use and type of building construction. You have the office and financial district, the central retail business district, and produce market, the warehouse and terminal districts, the industrial districts along the rail and water terminals, the apartment house districts and the private residence districts. Ordinarily, a building is appropriately placed when it is surrounded by buildings of similar type and use. Generally speaking, the highest land values and the highest rents are obtained where there is a certain degree of segregation as to the use, occupation and type of building construction. One purpose of zoning is to direct and supplement the natural trend toward segregation.

Without a zoning plan, the natural social and economic forces that work toward segregation are not in all cases sufficiently strong to prevent the invasion of a district by a use that is in appropriate and distinctly detrimental to the existing and more appropriate use of the property. You have all seen flagrant examples of widespread depression of property values caused by this haphazard development.

In many large cities there are examples of the same thing that is now happening on South Michigan Boulevard. Business spreads a few blocks along some main residential street leading from the central business area. As soon as these blocks are spotted with business, the remaining residences within the blocks are turned into boarding houses or lodging houses. The owners in the next block further up the street are then seized with a sort of panic. They think that what is happening in the block below is going to happen there. As a result the residents leave and their property is used for boarding houses or replaced by garages or other business structures. The process is repeated from block to block until an immense area is ruined. There is no economic justification for this movement. Only a few blocks of the enormous area affected would be needed for a normal expansion of the central business area. The damage has come because no limits have been set and no one can feel secure in the permanent maintenance of his block as a good residence section.

About the year 1913, the people of New York City began seriously to consider what was wrong with the existing methods of city building. New York real estate that had from time immemorial been considered a most safe and profitable investment had for some years been a drug on the market. Life insurance and savings institutions that had invested heavily in first mortgage liens on apartments, factory lofts and office buildings were compelled in many cases to foreclose and then to sell for much less than the amount of the first mortgage. This was a distinct shock to those who thought that nothing could happen to New York real estate. The city decided to stop and really try to think out the cause of the trouble and, if possible, to devise a means of overcoming it.

The buildings commission appointed early in 1913 made a careful study of the entire problem. It found that in the office and financial section of the city and in the factory loft section, the right to build to any height and over any proportion of the lot had led to most deplorable results. Each new building tried to push up higher than its neighbors in order to get light and air from above the tops of neighboring buildings. This high building would within a few years in turn be blanketed and have its light and air cut off by still higher buildings. As a result the darkened offices in the lower ten or fifteen stories of all buildings were rendered unprofitable and it was only in the upper stories of a few abnormally high skyscrapers that good office space could be secured.

The garment industries occupied the loft buildings on the side streets along Fifth Avenue. Thousands of employes in these factories came out of the buildings at lunch time to promenade up and down Fifth Avenue, thus congesting and blocking the sidewalks so as to drive away the trade of the high class shops along the avenue. This was one of the principal causes that led to the successive migrations of the best business section uptown from Broadway to Fourteenth Street, then to Twenty-third Street, and then up to Thirty-fourth Street. When the garment trades began to crowd into the Thirty-fourth Street section and above to about Forty-fifth Street, the so-called "Save New York" movement was started in order to prevent the further encroachment on the Fifth Avenue retail business section by the garment industries.

But these problems in Manhattan were not the only problems that caused New York to look toward a comprehensive zone plan. In the residential sections of Brooklyn, Flatbush, Flushing, Bay Ridge and many other suburbs, garages, stores, warehouses and manufacturing plants were coming into the formerly quiet residence streets and the detached residence sections were being invaded by high apartment houses.

The zone plan will keep trade and industry out of those streets and sections that are primarily suited to residential use. By so doing, the health, safety and general well-being of the community is advantaged and property values are conserved. When stores, industries and residences are intermingled, the quiet and comfort of home life is destroyed and the children playing in front of their homes are subjected to increased street traffic dangers.

The exclusion of business from the residence sections results in increased land and rental values both on the residence streets and on the streets or blocks in which business is segregated. The residence streets are better for residence purposes and the business streets are improved for business purposes owing to this common sense segregation.

The building zone plan should also protect the home sections by preventing any individual owner from appropriating an undue share of the common stock of light and air. The zone plan will accordingly limit the height of buildings and require the provision of open spaces about the buildings.

The limitation of tenement house construction is one of the most important problems in zoning. The tendency in most large cities for a larger and larger proportion of the population to be housed in tenements is very marked. Census statistics for 1900 show for the Borough of Manhattan 88 per cent of the population living in tenement houses. For New York City as a whole, the percentage was 71, for the Borough of Brooklyn 57, for the Borough The Bronx 53, for Chicago 42, for Boston 41 and for Cleveland 13. Observation and such statistics as are available indicate that in all of these communities, the proportion of the population living in tenements is rapidly increasing. With an increased population, all of these communities seem destined to become just as distinctly tenement cities as is the Borough of Manhattan, where over five-sixths of the people live in tenements. The general trend is not only toward a decrease in the proportion of the population housed in one or two family houses, but a gradual increase in the number of floors in the tenement house and a marked decrease in the size of the rooms and in the number of rooms per apartment. In the Borough of Brooklyn, New York, while a few years ago a large proportion of the new houses built were two family houses, now there are almost no new buildings of that character. In their place three or four story tenements are being built. While a few years ago there were many two and three story tenements being built, now most of these buildings are of the four-story type, while in certain sections the five and six story tenement is increasing rapidly. There is a continual tendency toward increased intensity of building construction and the more congested sections are those in which this tendency is most noticeable. Congestion breeds congestion.

While the Borough of Manhattan is a city of tenements, and the lower East Side the most congested area in the world, the city as a whole is not densely populated. In 1910 New York City had on the average only 26 people to the acre. Beyond a six-mile radius from the City Hall, there are enormous areas in the boroughs of the Bronx, Queens, Brooklyn and Richmond that are very thinly populated. With a proper transit system and a proper distribution of industry and of housing, the extreme congestion of population and industry on Manhattan Island would be entirely unnecessary. It is the province of zoning so to control the housing and industrial development that these evils will not be repeated in other cities.

The apartment house and the one or two family house cannot exist side by side. The erection of a single apartment house in a block is almost certain to mean a radical change in the residential population, a decline in the value of the single family houses and a gradual replacement of such houses by apartment houses. The reason for this is obvious. The quiet, seclusion outlook and attractiveness of the block from the point of view of the home owner is destroyed. The apartment house cuts off light and air from neighboring homes. It may tower above the neighboring private house and project beyond the established building line in the front or in the rear, or both. Attractive surroundings, a good outlook are important elements in creating good home conditions. Most of the value of the private home is destroyed if surrounded by the high blank walls of apartment houses. The walls of the apartment not only cut off outlook which is essential to comfort and vitality, but they also cut off air circulation and sunlight which is essential to health and comfort in a much more direct and unmistakable way.

The apartment house is very well suited to the housing of adults. It is not well suited to the rearing of children. From the nature of the case, children are a nuisance in an apartment house, and the apartment house is an injury to the children. The prejudice against renting apartments to families with children is well founded. Any sixteen family apartment with three or four children per family is bound to lack all the desirable characteristics of a home either for adults or for children. The noise from neighboring apartments, the children swarming in halls, stairways, courts and sidewalks, the general confusion and untidyness, the increased danger from all sorts of communicable disease make life in such a place much less worth while than it should be. The vitality, efficiency and morale of the race cannot be long maintained if the major portion of the people of our cities must grow up under such conditions of over-crowding. Degeneracy is certain. Our civilization is at stake.

Under a zone plan, the residence sections in which apartment houses are permitted should be strictly limited. As much area as practicable should be reserved for the one and two family houses. For a city like Cleveland it would seem reasonable to contemplate under a zone plan the housing of approximately one-third of the people in one family houses, one-third in two family houses and one-third in tenements. On this basis it is estimated that the one family house would occupy 60 per cent of the entire residential area of the city, the two family house 30 per cent and the tenements 10 per cent. In other words, to house one-third of the population in tenements requires only one-tenth of the residential area. It is clear, therefore, that if the proportion of people housed in tenements is to be reasonably limited, the area in which tenements are allowed must be very narrowly prescribed. Assuming the above distribution of one and two family houses and tenements and assuming that only 60 per cent of the entire available land area is used for residential purposes, it is estimated that over ten million people could be housed within a fifteen-mile radius within the Cleveland metropolitan area. On this basis the average density of population for the entire fifteen-mile radius would be 39 per acre; the average density within the portion of the entire area devoted to residential use would be 65 per acre.

In order to enforce a reasonable distribution of population in a great city, as above suggested, it is also necessary to enforce a corresponding distribution of industry. Without zoning regulations, concentration of industry in one section of the city leads to a congestion of population in the adjacent sections. Similarly, the congestion of population in any section of the city tends to a concentration of industry in the adjacent sections. It is the province of zoning to counteract these tendencies. The best conditions both for the industries and for the housing of the workers can be obtained where there is a proper balance between the areas devoted to industrial use and the adjacent areas available for housing.

We are apt to class all trade and industry together and assume that nothing can injure industrial sections. This is not true. It is not only necessary to provide for the segregation of industries in order to protect home sections, but it is also necessary to protect industries of the non-nuisance type from having located in their midst industries with noxious fumes and odors, such as fertilizer plants, reduction works, glue works or chemical plants. The location of industries of the nuisance type in close proximity to other industries of the non-nuisance type is distinctly injurious to the labor supply of the latter industries. Workmen do not wish to work or have their homes located near an area that is affected by the noxious fumes and odors of one of these nuisance industries. Manufacturers are finding that they need the benefit of zoning regulations in order to control the location of the nuisance type of industry.

There is one example of that kind in Cleveland, where I have been preparing a zone plan. The developer of a certain large factory tract was convinced that the application of restrictions to that manufacturing district would be reflected in the value of his factory sites. So he provided that those sites should be restricted against all nuisance types of industry, that is, fertilizer plants, glue works, boiler factories, etc. As a result, that section has developed as one of the very best factory sections in Cleveland. It is the section where the large automobile manufacturing plants are located. It has improved the labor supply, because within easy walking distance there is located a good residential section, where the mechanics employed in the factories can live and have good, comfortable homes, unaffected by proximity to any distinctly nuisance type of industry.

A zone plan worked out with relation to conditions in New York City or in Cleveland is, of course, not a model for any other city. The problems of each city are different. Zoning regulations must be worked out to meet these specific problems. Moreover, it is to be hoped that each large city in working out its zoning plan will develop certain new features that will be improvements on anything that has been theretofore adopted. The zoning principle is new and the possibilities of its development are very great. In working out its zone plan Chicago will doubtless make important contributions to the principles and methods of zoning.

Industrial Economics

By Harold Almert,
Consulting Engineer.

Presented November 24, 1919.

THE greatest problem before the American public today is how can we improve the productivity and efficiency of our labor. Before the European war the concerns that were organized to render the most efficient service to customers were the most successful. Before they were able to render a superior service to customers they had to instill the spirit of progress, efficiency and service in their own organization, and the degree of success attained, generally speaking, depended upon the degree of saturation of this spirit of service, efficiency and progress throughout their organization.

Since the beginning of the European war the mental attitude of labor toward its work, toward its employer and the public has changed. The desire to serve has gone, the desire to strive for efficiency, for efficiency's sake, has gone, and instead the desire seems to be to deal with its employer at arm's length and each day bargain for a shorter day, higher pay and less work.

With the increasing cost of the necessities of life the workingman has obviously had to have material increases in pay, and in so far as the increases went to make up for the increased cost of living there is no cause for complaint unless labor itself by its own acts has been responsible for the increased cost of necessities. To anyone that has made a study of commodity prices it is obvious that pre-war prices for labor and material will never return. The sooner we all realize that the sooner we will begin to progress again.

Nevertheless, commodity prices must come down in this country if we hope to keep our place among the industrial nations of the world, and in our effort to bring down commodity prices care must be exercised that we do not reduce still further the purchasing power of the workingman's dollar, but rather increase it and make every effort to bring it back as nearly as possible to what it was before the beginning of the European war.

Industrial engineers have studied and written much on increased productivity of labor and machinery. In a great many cases their efforts in improving production by the aid of new and improved machinery has shown remarkable results; but the cases recorded where the productivity and improvement in human efficiency were obtained are very few and far between. In other words, in the last decade the wonderful improvement in production may be nearly all credited to improved methods and machinery and very little to improved efficiency by human efforts.

Take such a simple task as reading for example. Repeated tests show that with men or women of equal training and experience one man or woman will read four times as fast with equal accuracy as another. F. W. Taylor observed that "A first-class man can in most cases do from two to four times as much as is done on the average." His conclusion applies to all trades and is not based on a spurt or period of over-exertion. It was simply what a good man can do and keep up for a long term of years without injury to his health, but become happier and thrive under. Professor Scott observes that the "men who know how to get maximum results out of machines are common; the power to get maximum of work out of subordinates or out of yourself is a rare possession."

It is generally recognized that the first step in the direction of lowering commodity prices is greater production, providing more machines and employment of more men will increase production in one sense, but it will not reduce prices. The productivity of the individual must be increased to bring down prices. If it can be shown that labor is primarily the cause of increased prices and that labor can, without injury, restore former conditions and even materially improve them, then it is up to labor and we must look to labor for the solution of our present conditions.

Let's just look at a few examples to see if labor can materially reduce costs and prices.

Of the commodities that increased the least during the war, public utility service is the best example; by that I mean the cost of service to the consumer. The cost of rendering the service went up like all other lines. From a recent study of the cost of labor on pole line construction for telephone and electric light companies the following conclusions were drawn:

TABLE "A."

Year	Rate paid Per hour Weighted Average	Time to do Work	Per cent of Increase on Time 1912—100%	Resultant Labor cost Per hour
1912	25c	25 M	100%	25c
1913	25c	25 M	100%	25c
1914	25c	22 M	88%	22c
1915	27½c	20 M	80%	22c
1916	30c	28 M	112%	33.6c
1917	35c	32 M	128%	44.8c
1918	42½c	42 M	168%	71.4c
1919	50c	49 M	196%	98c

I am reliably informed that before the war 20,000 men produced 40,000 automobiles in a month in Ford's plant, which today it requires 35,000 men to produce 20,000 cars, an almost unbelievable reduction in human efficiency.

During the war coal operators in Illinois made a handsome profit under the government price of $2.35 per ton for mine run. Under patriotic appeal the miners worked full time every working day. The mines were operating at 100 per cent load factor. Then came the armistice, everybody let down and everybody relaxed. Miners had accumulated a great deal of money, they began easing off, so that in thirty days the production had dropped to 33 to 40 per cent of the maximum. The cost of mine run at the mine due to reduced production ran up so that the operators instead of making a handsome profit actually suffered a loss on the government price.

Take another example of cost of construction. For illustration a study was made of the cost of steel, cast iron, labor and other materials that go to make up the cost of building a gas plant and distribution system. Taking the costs in 1910 as 100 per cent, the costs in 1918 were found to be 87 per cent higher. Here again part of the increased cost was due, in a large measure, to the decreased efficiency of labor.

One telephone company found that before the war installers would put in five to six telephones per day. Now the installers get twice as much pay and install only one telephone per day. Therefore, the total installation cost is ten to twelve times higher than before the war.

If the above cases are true and labor has done much more work in the past and without detriment to health and happiness, and if this is the first step, if indeed not the only one that will quickly and effectually begin a reduction of costs and prices, is it too much to ask labor to lead off to restore former conditions? If it is true that labor caused the present condition not wholly but in a large part, then isn't it reasonable to expect labor to put its shoulder to the wheel and start the improvement rolling? Will labor by simply directing these conditions to its attention apply the remedy? I think I can say without fear of contradiction that it will not. If labor was free and unshackled. Yes, but the parasites who mingle with labor and rule labor and who are responsible for this condition of unrest will never consent to a return to former conditions when we were seeking to improve human as well as mechanical efficiency and to measure compensation on the ability or productive capacity of the individual. Constructive progress cannot be hoped for with labor's present attitude. The radicals and parasites who now control and speak for labor have to be routed and the intelligent and conservative element returned to control. When labor regulates itself productive capacity and quality of labor will be recognized. At such time the introduction of both financial and non-financial incentives will stimulate productive capacity. Due to constant agitation of radicals, labor is not only indifferent but actually hostile to the introduction of principles and elements that will bring about lower costs and prices. Therefore, the methods used in the past will not suffice but a thorough understanding of psychology applied to business will be necessary.

The wonderful growth of the steel business was due to competition for efficiency with achievement and production as the goal. Professor Scott tells us that the Carnegie system was one of the most comprehensive application in business of man's instinct of competition to the work of increasing individual and organization efficiency. In a short paper with a divided evening such as this time will not permit of a discussion of the relative merits of competition, imitation, handicapping, monetary reward, promotion and public commendation, etc., as a means of stimulating production. Almost any business man can build and equip a factory with efficient machinery, but the man who can select a force of men to operate that machinery, train and bring them up to the maximum production and then maintain it, is rare. The big problem which we all have to face is to make a closer study of human nature and in the future make more accurate selection of to insure getting the right man in the right place. Then prove to him that he can produce two to four times as much in the future as he has in the past, and while so doing, study him, make his work interesting so that he will be contented, all of which is, of course, easier said than done.

I don't know the name of the author, but some one has written a very pithy bit of prose entitled "The Spirit of Progress" and in closing I am going to read it to you. I have found it quite a spur and I am sure you will too.

"The greatest asset a business or an individual can have is the Spirit of Progress. Without that all else is largely in vain. With it every good thing is possible.

"What is the Spirit of Progress? It is the desire to know what constitutes true success and the willingness to take the patient steps which lead to it; the desire to correct errors, traits and tendencies which retard progress, and the willingness to receive new ideas and act upon them; the desire to act from sound motives, and the willingness to give up false and temporary success for vital and permanent growth; the eagerness to utilize every wholesome opportunity, the enthusiasm to strive for excellence for its own sake, and the energy to push on, pausing only when the victory is won.

"With this spirit the growth of a business is inevitable. It is as natural as for a tree to grow.

"The world may furnish many opportunities, appreciation will quicken some motives, and the onward movement of the world can change some conditions, but that spark of fire—The Spirit of Progress—must come from within, must spring up in a moment of noble resolve, and must never be allowed to die, never to wane, and never to waver.

"Examine into the lives and actions of men who have made the real successes in any wholesome line of activity and you will see how that vital spark made all their achievements possible—and maybe you will find the spark yourself."

Central Station Power as a Factor in Effecting Economies and in Increasing Production

By George H. Jones,
Testing Engineer, Commonwealth Edison Co.

Presented November 24, 1919.

THE subject of a "Central Station Power as a Factor in Effecting Economies and in Increasing Production," is an extremely interesting subject and is becoming one of paramount importance in these days when the utmost efficiency must be secured in every line of endeavor. Of course, in a limited time it will be possible to only touch in a general way upon some of the most important features of this broad subject.

I believe you will agree with me in concluding that the consensus of the best thought of the day is that we must, among other things, increase production in order to re-establish balance in our economic life and make up as rapidly as possible the stupendous wastage of war as well as to meet the unusual demands of the new era upon which we are now entering—an era in which the mass of the people are demanding improved living conditions and the opportunity to live larger and fuller lives. As a self-evident corollary, our new industrial program would not be complete if we did not take every possible measure to conserve our resources, abandon wasteful methods and apply our best effort to bring about a condition wherein the maximum service is secured from capital, labor and materials.

The need of increasing human efficiency is important, but we must in addition more generally apply science and machinery to the present day industrial problems of production and distribution.

Even the most casual observer will recognize the fact that electricity will play a very important part in this program. It is, in fact, hard to find a business of any kind in which electricity is not utilized in some degree. This mighty force, which has come so much under the control of man, is so interwoven with our modern life that it would be hard to realize the condition in which we would find ourselves if we were suddenly deprived of its use. Electricity assists in an increase of production in a multitude of ways. By its use, machinery can readily be grouped with reference solely to sequence of operation, and then, too, any desired range in speed control can be secured at will.

We need simply to turn to the history of the war to reassure us as to the pre-eminent position this wonderful force holds in the life of the day, and a recital of the many ways in which electric power was applied to speed up production of the war machine would, indeed, make interesting reading.

The function of the central station is to put this modern giant at the service of the entire community, from the smallest manufacturer to the largest industrial establishment, including those situated in the rural and farming districts as well as those located in metropolitan areas. This is a function of far reaching importance, especially in these days of labor shortage, wherein motor driven labor saving devices must be very largely relied upon in order to enable us to meet the every day needs. In fact, a cartoon appearing in one of the papers this morning brought out this thought very well, wherein it suggested as a suitable motto for today, "What is home without a motor."

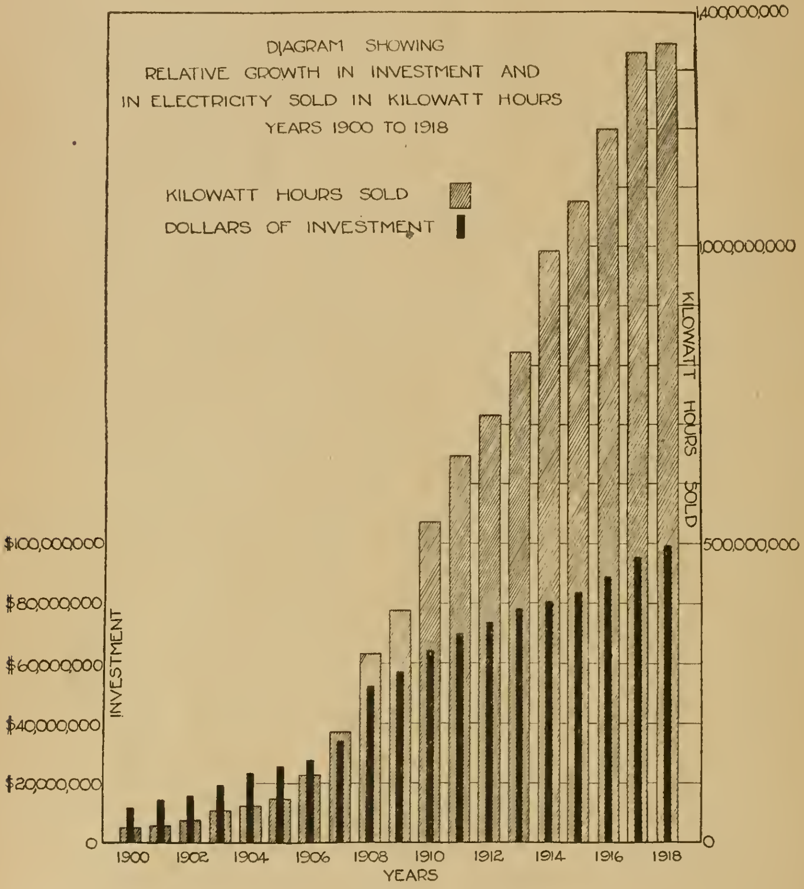


Fig. 1.

Granted, therefore, that electricity is an indispensable aid in increasing production in that by its use we can apply power in the most direct manner, and that by the use of central station service this power can be made available universally, the question of the most economic production and distribution of that power is of vital importance.

This is a subject which has become very fascinating to me, especially in the light of efforts that were made during the war period, for example, to conserve resources—principally coal. We were all inconvenienced by lightless nights and heatless days and as our contribution for the common good cheerfully submitted to this inconvenience. The amount of fuel saved thereby was, however, insignificant when compared with the possibilities of very largely eliminating the astounding losses now being icurred daily.

It does not require a very deep study of the problem of power production to realize that fuel at the present time is being wasted on a stupendous scale, being used in many cases in small, efficient plants, as against the possibility of utilizing it in the production of power in the large units of our modern central stations whereby the maximum of economy is secured. The economies to be secured, however, by centralization of power supply cover more than mere coal, as they include the entire field of capital, labor and materials.

As I am most familiar with the operation of the Commonwealth Edison Company, I will use Chicago data as typical:

Fig. 1 shows how the growth of the central station business aids the conservation of capital. You will notice that the heavy vertical lines indicate the total investment for the various years, whereas the cross hatched lines show the output in kilowatt hours for the corresponding years.

The significant feature of these curves is the conservation of capital in that the kilowatt hours of output is increasing at a much faster rate than the investment. In other words, we are constantly getting more use out of every dollar invested.

A companion curve, showing investment required for the same output, but based on production in a multitude of small plants, would show a much higher total investment due, First, to lesser generating capacity required in the central station due to the diversity factor existing between the various kinds of load served; Second, to greater cost per kilowatt in the case of smaller plants due to the use of relatively small generating units, and, Third, by interconnection of central station generating plants, the amount of reserve generating equipment is reduced to a minimum.

Fig. 2 shows in a striking manner the conservation of labor in the production of central station power although it only tells half the story. For the last twelve years the number of employes per kilowatt hour of output has very materially decreased year by year. In other words, the requirements of man power in the central station business is increasing at a much lower rate than the increase in the output. In addition to this showing of labor conservation should be added the labor that would have been required had the same amount of power been produced in small plants which would necessitate the employment of much additional labor per unit of output.

At the moment, however, probably the item of conservation that is most important is that of coal. Fig. 3 shows the wonderful decrease in the pounds of coal per kilowatt hour of output from 1903, when it was about seven pounds, to the present day economies of about two pounds of coal with present day large units. The

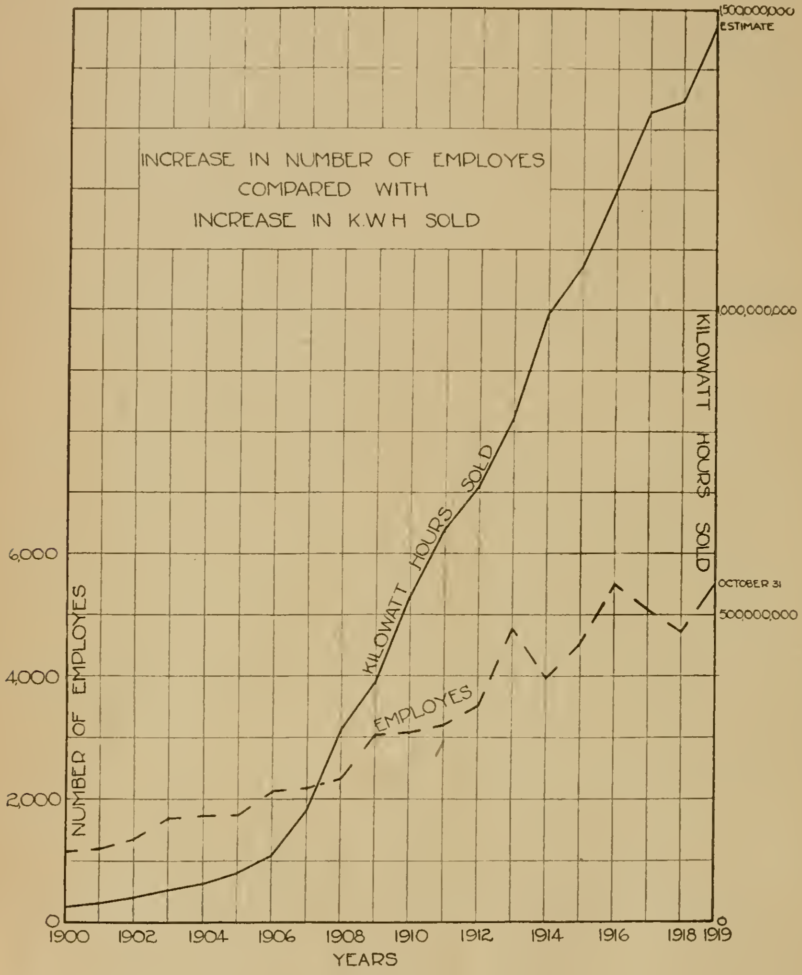


Fig. 2.

significance of these figures is apparent when you realize that in our Chicago stations we are burning coal at the rate of about 2,000,000 tons per year. Imagine for a moment the appalling losses to the resources of the country if this power were produced in small plants with corresponding increase in the fuel rate. For a striking example, I would cite the instance of a plant concerning which I have obtained reliable operating data within the last few weeks. This particular plant has a capacity of 5000 Kv-a. in three units; is modern in every way; is operated condensing, and has available an unlimited quantity of cooling water. Under these conditions you would probably assume a fuel economy of four or five pounds of coal per kilowatt hour. The actual operating record shows the plant is using seven and one-half pounds per kilowatt hour. This poor showing is no doubt in large part due to the fact that the load on this particular plant is a variable one. However, if this load were carried by the central station, the total saving in coal due to the increased fuel economy in the latter case will be about 5,000 tons per year. In this particular instance none of the complications arising out of the possibility of using exhaust steam for heating are involved, as the plant is run condensing the entire year. I think it is a crime to waste capital as well as coal in this way.

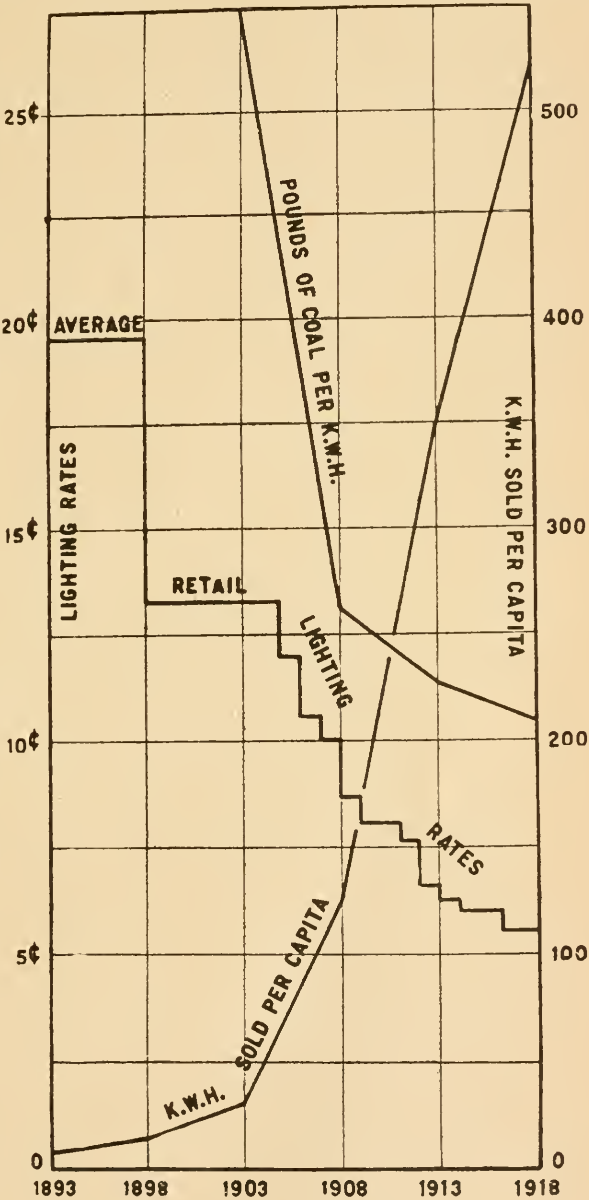


Fig. 3.

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Another installation somewhat similar, but smaller, came to our attention some three years ago, where a 1000 Kw modern steam turbine plant, running condensing by the use of cooling tower equipment, had been actually using coal at the rate of twelve pounds per kilowatt hour, and that, too, for several years. Facts of this kind, I believe, are not generally known, so I am very much pleased to be able to present them to you at this time.

During the war when Fuel Administrator Garfield announced that it was necessary to save something like 50,000,000 tons additional during the year 1918, it occurred to the writer that a very large saving could be made by the use of central station service in connection with the operation of existing non-condensing isolated plants—by having these plants operate merely during the winter months when the steam heating requirements were heaviest, and by having the central station furnish electricity during the summer months when there was no need for exhaust steam. We thereupon secured summer service contracts for about a dozen plants in the Loop district, the total maximum demand of which is 2176 kilowatts, for which we furnished 4,000,000 kilowatt hours. The operating records of the best of these plants (which by the way were modern in every way and had been installed within the last five years) showed they were using about nine pounds of coal per kilowatt hour. The substitution of our service for this small group of plants resulted in a net coal saving of 13,000 tons per year, this saving being figured on a very conservative basis, as the difference between the operating efficiencies. If this same 13,000 tons were consumed in our stations they would produce 50 per cent more electricity than is required in Marshall Field & Co.'s retail store for a whole year. This amount of electricity represents approximately 10 per cent of the entire annual output of the Public Service Co. of Northern Illinois, and is also equal to the entire amount of electricity consumed in the city of Evanston, for instance, for a period of fifteen months.

All of the above facts might only be of academic interest to the user of electric power if he did not directly benefit by the many economies to be secured by central station operation.

Fig. 4 shows the situation very clearly: I would like to emphasize the fact that even since the commencement of the world war a reduction in rates has taken place in the city of Chicago, whereas everything else entering into the cost of power production has increased very materially. These curves were prepared from government data and cover the year 1918. We know too well that the cost of various commodities have not come down since that time, and, in fact, in most cases are even higher.

During the last fifteen years the prices for electric service have been gradually reduced as greater economies of production have been secured. The same forces which made possible these reductions are still in operation, namely, Gradual improvement of load factor, increasing volume of business, increased efficiency in generating equipment, and gradual increase in density of business.

Of course, no one can tell how long these factors can sufficiently offset the increase in cost of labor and material entering into the production of central station power to prevent the necessity of rate increases; but in any event the presence of these economic forces precludes the possibility of an increase in the cost of central station power at all comparable with the increased cost of power production in the relatively small isolated plants that are by the nature of things outside of the realm of operation of these powerful agencies.

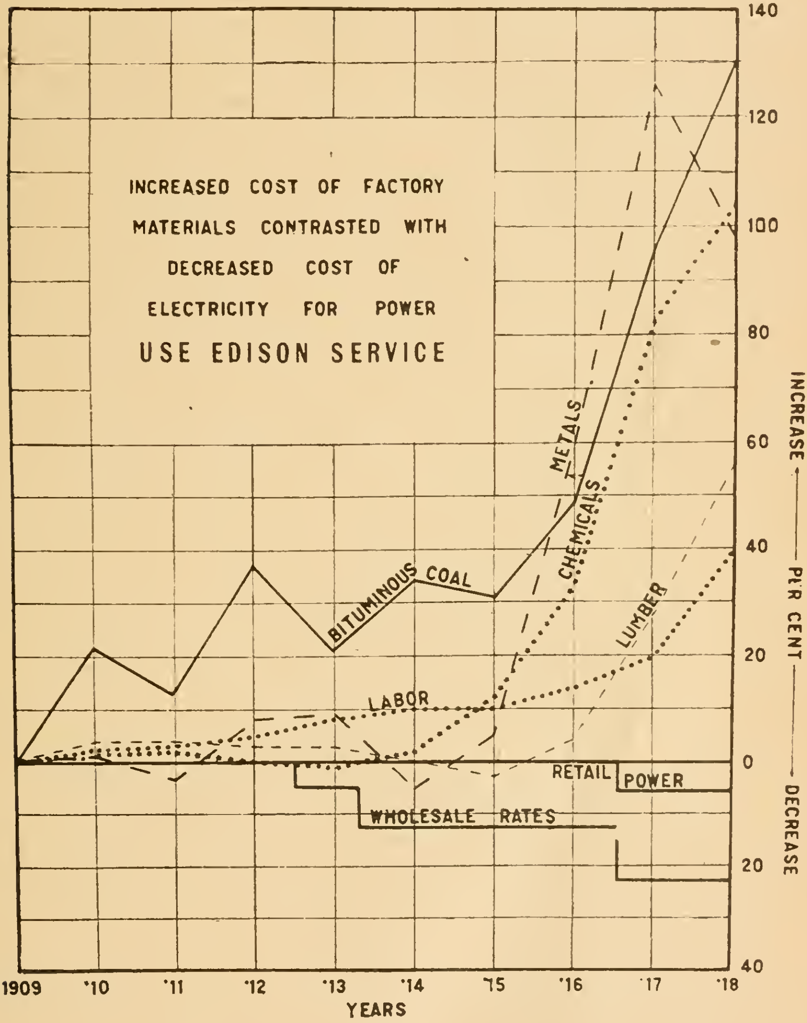

Fig. 4.

January 20, 1920

The Relation of the Professional Technical Man to Civic Progress

By Henry K. Holtzman,
President, Illinois Chapter, American Institute of Architects.

Presented October 21, 1919.

In order to consider intelligently the proper relation of the professional technical man to civic progress, one must understand what is known by the term professional technical man.

The professional man may be known by the nature of his remuneration, by the nature and scope of his work and by his ideals.

The professional man works for a known fee and not for an unknown profit. This fee may in proportion to the cost of preparation or the hazard of the undertaking, but does not bear any proper relation to the value of the service. The professional man may receive a fee which is but a mere pittance for a service which is of incalculable value to his client or the public.

The professional man must lay the foundation for his service deep in the achievements of the past and must spend long years in acquiring the fundamental principles of his calling. When he has reached a point where he can render service in his professional capacity he must still continue preparation and improvement. He may spend 25 per cent, or 50 per cent, or even 75 per cent of his time and effort in research and study, in preparation for his future client.

As soon as a professional man participates in the profits or losses, or has any interest in the outcome of his efforts other than the good and the true, he loses his professional nature. This principle is well recognized in the law, and it has long been practiced by the wise physician. The judge refuses to hear the case when he is in any wise personally interested in the outcome. When the physician falls ill he refuses to diagnose his own case, knowing that he is liable to prejudice on account of his own self-interest.

The scope of the professional man's activity partakes of what is known as the specialist. No man who claims to be a doctor, a lawyer and an engineer would be regarded as a true professional man. To achieve in any one profession or in any division or specialty in a profession is sufficient for the efforts of one man. The sub-divisions or sub-professions of the technical professional man are perhaps best known to this body of men. We speak with careless consideration of the mechanical, the electrical, the structural engineer, the advertising or the efficiency engineer—the artist may achieve to a technical professionalism—these professions, moreover, may overlap. When structural work and art combine we have architecture, when manufacturing and art combine we have the industrial arts.

Perhaps the professional man is best known by the ideals which govern the nature of his service. He is a man that must deal with action and reaction without prejudice or favor toward either. He must continually regard the rights and liberties of others. He cannot advise, or participate in, the breaking of any of the laws of the realm. He must not permit the use of power for power's sake.

Time was when the professional statesman styled himself a prince or an emperor and was thought to be a professional man. But when he used the power to which he had attained for power's sake he and his type of profession were wiped off the map. Time was when the labor leader may have been regarded as a professional man—consulting, advising and urging action and reaction for the good of his clients and the public without regard to his own remuneration or his own power or glorification. The moment he uses his power and influence for the glorification of the power itself he ceases to perform in a professional manner and must be wiped off the slate.

With this understanding of the significance of the professional man we may consider the relation of the professional technical man to civic progres. If there be such an ideal class of men, and if there be any great number of such idealists they could be of great service to the public in civic, governmental or sociological progress. Civic progress, like any other progress, mechanical, structural or artistic, must proceed in an orderly manner and in harmony with universal law. Any other course leads to confusion or to disaster. The need of the professional spirit is everywhere apparent in public affairs. It is illustrated just now in this city by the need of city planning and zoning. The growth of the city without the guidance of the disinterested professional man goes on in haphazard manner until it gets into confusion and difficulty, and then, like the man who made his own contracts without the advice of a lawyer, turns to the professional man to get him out of his trouble. If the building of the city had proceeded with the advice of the professional man an orderly survey of the conditions and requirements would have been made, and the professional man with his habit of procedure would have platted all of the facts that would have been likely to bear upon the solution of the problem—would have then evaluated each of these facts and requirements and in a logical manner would have evolved a plan for the growth of the city in an orderly way. Under such a procedure, form would follow function as the night the day. Out of such a plan would have come harmony and beauty instead of confusion and disaster.

But how can the professional technical man apply his motive power and his mental processes to civic progress? First of all there must be created a professional class consciousness. The public must be conscious of the nature of the professional mind—the training it has been subjected to and it must be conscious of the extent or numerical strength of the professional class. The professional class must be conscious of itself, and conscious of its ideals and its duty to the whole public, and it must lift higher and higher the banner of SERIVCE and fix itself immovably upon the principle that public interest must have precedence over self interest.

January 20, 1920

It is my firm belief that there now exists in this republic a great and powerful professional class. It only needs to be organized to be visualized. It is of the utmost importance, therefore, that the first duty of the professional technical man is organization. The prime object and the principal reason for his organization is class consciousness. We have the ideal of the professional man in abundance, but we have it scattered without organization and without leadership, and without recognition on the part of the public.

An example of the use of the professional class for the public good may be seen in an analysis of the conference on industrial conditions now assembled in Washington. It was a comparatively easy matter for the President of the United States to summon to Washington men representative of the employe class. It was doubtless comparatively easy to find able representatives of the employer or capitalist class; but one must assume that it was very difficult to find representatives of the public or the middle class, for we find as representatives of the public such men as the head of the great organized steel industry and such men as the head of the oil monopoly attempting to function in a conference of national moment as representatives of a class having no prejudice for or against either the capitalist or the laborer. I venture the assertion that if the professional classes were one-half as well organized and visualized as the laboring class today is, or as the capitalist class has been for many years, it would not have been difficult to select from the professional men those who were able to weigh and balance contending principles of the opposing classes, to survey and evaluate the motives of action and reaction and to render a just balance between the two.

The need of the professional technical man in civic affairs is exceedingly great. The need of an organization of all of the professional technical men in one great body is equally important and equally urgent. Steps have been taken toward the organization of a federation of all the technical professional men of Chicago. When this is accomplished it should not stop here. The same process should take place in every city or civic center and these in turn should all be combined in one great national professional body.

The world is fast becoming aware of the great value of the professional man. He is the man who stands ready to serve other men in their health and happiness, in their organizations and enterprises, in all their conceptions and achievements. What great commercial enterprise or what mighty utilization of forces would have been achieved by the so-called masters of industry had it not been for the professional man who patiently and systematically worked it out, practically for the joy of achieving it; or what one of the great machines of finance or industry, or what government in war or peace could survive and develop, but for the continued devotion of the professional man? His services are not paid for in proportion to their value, and for some things he cannot be bought. He is born of the people, seldom if ever of autocracy. His equipment is inherited from society and he is the safest and most important trustee for the preservation and development of society the world will ever know.

We are now awakening to the dawn of a new era. The age of kings and princes is past. The day of barons and aristocrats is waning, and the day of professionalism is at hand. Professionalism carries but one banner and written on that banner is but one word—Service. The law of its being is freedom restrained by culture, training and unbiased devotion to duty. The remuneration of its members is a known fee in proportion to the cost of preparation and the hazard of the undertaking, coupled with that distinctive mental exhilaration known to no other calling—the joy of solving a problem that makes life still more worth living. The professional spirit is marching on toward that day when

"Only the Master shall praise us, and only the Master shall blame;
And no one shall work for money, and no one shall work for fame;
But each for the joy of the working, and each in his separate star,
Shall draw the Thing as he sees it for the God of Things as They
Are!"

It is our chief duty to develop our organizations in order to develop our class consciousness. By serving with each other in close contact and fraternity we can develop an awareness of our combined strength and power. To belong is not enough—to participate must be the watchword. When we know each other as individuals, we can make ourselves known to society as a class. We may not have been first in war, but we can be first in peace. Let us stand by the professional ideal, to ourselves be true, and unite in one great body and one great purpose, to serve organized society everywhere within the field of our usefulness, with one great unselfish professional organization.

January 20, 1920

The Comparative Economics of Cantilever and Suspension Bridges

Economic Span Lengths for Simple-Truss Bridges on Various Types of Foundation

By Dr. J. A. L. Waddell, M. W. S. E.

[Editor's Note.—These papers were printed in Vol. XXIV, No. 4, April, 1919, in advance of their presentation before the Western Society of Engineers by Dr. Waddell.]

DISCUSSION.

Mr. Haggander: Gentlemen, this evening we are honored by the presence of Dr. J. A. L. Waddell, Consulting Engineer, who will present two papers. The first is on the subject of "The Comparative Economics of Cantilever and Suspension Bridges" and the second is entitled "Economic Span Lengths for Simple Truss Bridges on Various Types of Foundation." These are two of the series of papers which Dr. Waddell has under preparation on bridge economics. Dr. Waddell will present both papers, after which we will have discussion on them.

Dr. Waddell: I am going to give you the last written paper first. It deals with simple spans, while the other deals with more complex ones. (Reads first paper.)

Now I want to say a little about ordinary economic investigation in engineering. A great many of them have been made by means of mathematics, and I can tell you plainly that they are absolutely unreliable and are failures. Take, for instance, the case mentioned that I worked up years ago. I thought I had solved that problem correctly; for I reasoned it out that the floor system being constant should not be counted in. Therefore I found by mathematics that the cost of a pier should equal one-half of that of the trusses and laterals of the two spans which it helps to support; but to determine this criterion I made certain assumptions that would hold for certain conditions; but it seems now that they do not for others. On that account some of my deductions were incorrect. That criterion, which I have been working under these many years, has proved to be unreliable, I am sorry to say. Now you have something that you can truly rely upon; for these calculations that I have made are correct. There is no gainsaying their results. The prices assumed are well adjusted and the results come out so nicely in plotting that there can be no doubt about the correctness of the work.

(Reads second paper, injecting following remarks.)

I would say there is a hiatus in there. I have given a number of reasons that I didn't quote here. (Reads: "For a number of years the writer has had the desire to settle this economic question." . . .)

Those marks were left out by my Japanese draftsman and do not occur in the paper. Consequently I have corrected the clause I have just read, cutting out that reference. (Reads: "It will be seen that no curve was drawn." . . .)

I would say, though, that "Bridge Engineering" has come to its third thousand, and this modification has been incorporated in that and future additions. (Reads: "The division of total metal work" . . .)

Finishes second paper; reads addendum.

Mr. Haggander: Gentlemen, these papers will now be open for discussion. The subject is so broad that it is hard to discuss in a meeting such as this. Possibly someone has some questions to ask or something to add to the discussion on some of the points brought out.

Question: Did you make a study of the bridges that have been constructed, for the purpose of comparing the different types?

Dr. Waddell: Well, I knew about them. I assumed the same data for the cantilever and the suspension bridges. You see I have been designing both cantilever and suspension bridges for a number of years. Years ago I designed a cantilever bridge with an 1830-foot opening, and as long ago as 1886 I made a design for a suspension bridge of 1500 feet. Moreover, you have to have all of the assumptions alike for the two bridges in order to make a comparison; hence I couldn't make a comparison of structures already completed.

Mr. Haggander: I know of one case in which a double-track bridge, on a rock foundation, checks up very closely with this paper. Do you know of any cases that help to bear out this paper?

Mr. Dalstrom: I would like to ask to what extent suspension bridges have been constructed for railway purposes?

Dr. Waddell: Very few indeed; and, for my part, I don't favor them at all except for very long spans—so long that you cannot build the cantilever structure. As I showed, the span for equal cost for a strictly railroad bridge is about the extreme limit that you can build the cantilever, the curve of cost in the cantilever bridge runs along like this (slightly inclined) and then suddenly curves upward very sharply. The point where it turns to go up rapidly is the place where the curve of the suspension span crosses it. I don't believe in building railroad bridges of the suspension type. The cantilever is more rigid than a suspension bridge and therefore better. The simple-truss span is more rigid than any cantilever, and therefore better, but of course there are economic limits for the different spans. I once designed two highway bridges, one of them with a simple span of 1100 feet and the other a simple span of 1040 feet. I beat all the other designs on costs and came within the limit set. It showed what could be done to meet certain unusual and arduous conditions. In my paper on "The Possibilities in Bridge Construction by the Use of High-Alloy Steels," I computed simple spans up to a thousand feet in length.

Question: What would you consider the comparative costs of maintenance between the cantilever and the suspension bridge?

Dr. Waddell: I don't think there would be much difference. Perhaps the cantilever bridge would have more area to cover with paint. That is about all, I should think. But those cables would have to be painted and cared for, and they are more troublesome to paint than any other part of the structure.

Question: What conditions of loading and theory of stress were assumed for this work?

Dr. Waddell: I employed the old standard theory that was worked out many years ago, and it hasn't been superseded since. The loads were the same as used in the cantilever computations.

Question: The reason that I asked is that many years ago I found that all of the books that I could find were incorrect. The equations for determining the stresses in a stiffening truss were evidently established by calculus, by putting the load on one end and integrating between limits. I found that by putting a train of half the length at the middle of the span it might over stress the trusses.

I noticed that in the suspension bridges which you have shown in your paper the anchorages are apparently placed on piles about twenty feet above rock. What takes care of the lateral thrust in a case like that?

Dr. Waddell: We never do rely on piles to take care of lateral thrusts. You have to have some pretty solid material for that purpose. You can't build a suspension bridge in a swamp.

Question: I supposed that if it is simply on soil and the weight is adequate for anchorage, the earth in front of it and the friction on the base would take care of the thrust.

Dr. Waddell: It doesn't do to put the anchorages on piles in very soft material. You ought to have good solid material. I assumed them in my estimates as a matter of comparison. If you had very hard material you wouldn't want them. You have to have enough material in front to take up the horizontal thrust. It is only the inexperienced man who will put an arch thrust on an abutment that rests on piles without providing proper backing behind it.

Question: There is another thing that I noticed in these designs. I always thought that in the interests of economic design the depth of the truss should rather closely follow the moment curve in order to get economic structures. I didn't notice that in any of the cantilever designs, or the suspension either, that you have shown us tonight or mentioned in your paper.

Dr. Waddell: I worked that question out over two decades ago and published the results in De Pontibus.

Adjournment.

A Gateway—Electrical

ONLY a forty-foot gateway bounded by two brick pilasters and ornamental lamps, but unlike any other gateway in the entire world.

For back of it is the General Electric Company's main office building, accommodating 2300 employees. And just next door is its laboratory with the best equipment for testing, standardizing and research at the command of capable engineers. Then down the street—a mile long—are other buildings where everything electrical, from the smallest lamp socket to the huge turbines for electrically propelled battleships, is made by the 20,000 electrical workers who daily stream through.

What a story this gate would tell, if it could, of the leaders of the electrical industry and business, of ambassadors from other institutions and from foreign lands.

The story would be the history of electric lighting, electric transportation, electric industrials and electricity in the home.

This gateway, as well as the research, engineering, manufacturing and commercial resources back of it, is open to all who are working for the betterment of the electrical industry.

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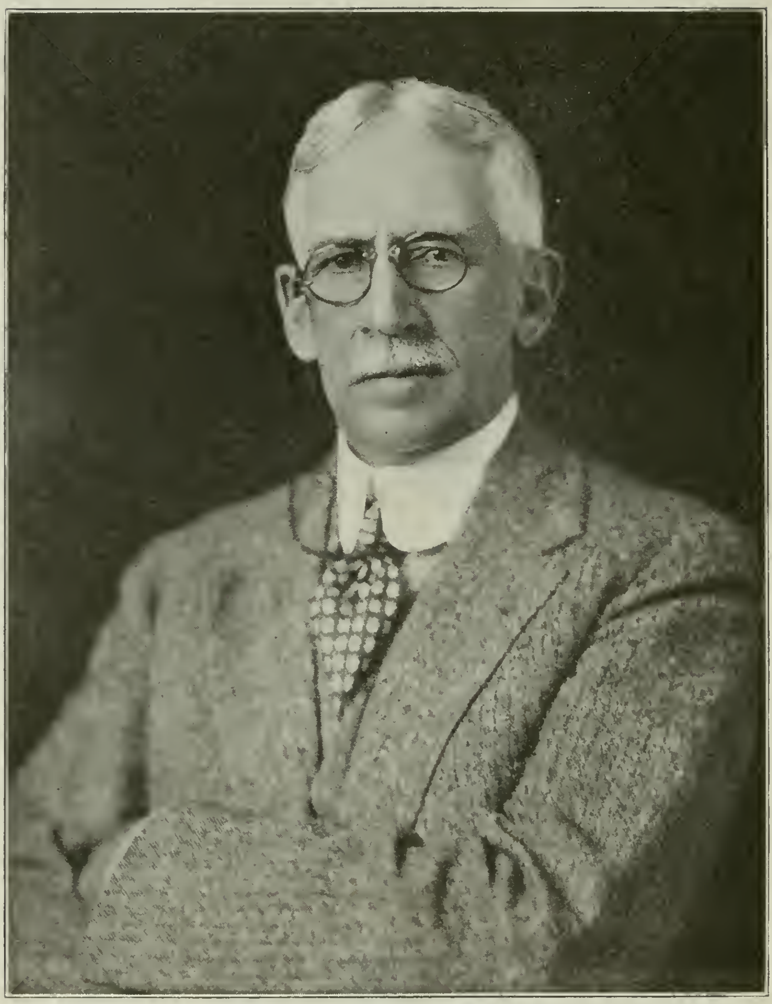


FREDERICK K. COPELAND
President—1920

CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV FEBRUARY 5, 1920 Number 3

COPELAND OUTLINES 1920 PROGRAM

400 ATTEND FIFTIETH ANNUAL MEETING

General Wood Urges Strong Army Reserve Corps of Engineers

A. S. Baldwin Retires

Frederick K. Copeland, the new president of the Western Society, sounded the keynote for 1920, when, in his inaugural address at the annual dinner January 28, he said:

"We must all strive this year to increase the strength of the Western Society. We must add to our numbers; we must emphasize more strongly the professional development of the engineer by the organization of more sections of the Society for study and research; our organization must play an important and decisive part in civic affairs; and, we should endeavor to develop the social life of the engineer beyond the accepted limits of the profession.

"In other words, each and every one of us must show our loyalty and willingness, by giving of our time and energies, to take part in this great development of the Western Society of Engineers."

The fiftieth annual dinner of the Society was one of the most successful in its history. Approximately four hundred were present and, to use a much overworked expression, "a good time was had by all."

Major General Leonard Wood, U. S. A., the principal speaker of the evening, paid high compliment to the engineer, saying that "in all colonial development, especially that of the United States, the engineer has preceded the establishment of all law and order."

In the Philippines, Cuba and other possessions of this country, the foundations of good government have been laid down by the engineering

(*Continued on page* 17)

WHY ENGINEERS SHOULD CULTIVATE APTITUDE IN LITERARY EXPRESSION

By William E. Keily.

Editor's Note.—This is the substance of a talk at a meeting of the Program Committee of the Western Society of Engineers held in the rooms of the society on January 19, 1920. To this meeting other gentlemen interested in the publications of the society and in the broadening out of the "Journal of the Western Society of Engineers" were invited. Mr. Keily, as a man having some experience in newspaper and literary work, was asked to attend to discuss particularly the matter of securing and presenting material for the Current News Section of the "Journal."

What we have to discuss may be considered under two aspects—(1) the value to the engineer himself of the ability to express himself in print with precision and grace, and (2) practical suggestions in relation to the writing of news articles and news items for the *Journal.*

As to the first consideration, it seems to me that engineers have particular need of the broadening out that clear writing involves. Concerned largely with problems relating to the control of the material forces ot nature, engineers are peculiarly subject to the temptation of overemphasizing material things, overlooking, perhaps, the importance of the human element and of influencing the minds of men by reasoning and persuasion.

Lawyers do not neglect this tremendously important possibility, and it is largely for this reason that they are apt to become more prominent in public affairs than engineers. The greatest study of mankind is man.

(*Continued on page* 22)

ENGINEERING COUNCIL JOINS CHAMBER OF COMMERCE

Engineering Council has been elected to membership in the Chamber of Commerce of the United States. In joining this great association of trade and commercial organizations, Engineering Council adds its strength to organized business and gives its members an opportunity to register their views with the central body in the consideration of national questions that affect business. Engineering Council represents five great national societies of professional engineers.

Mr. Harold W. Buck of Viele, Blackwell & Buck, consulting engineers, New York City, and past-president of the American Institute of Electrical Engineers, has been appointed as national councillor in the National Chamber.

On January 24 only 900 membership applications remained to be acted upon.

C. F. W. FELT
First Vice President

COPELAND OUTLINES 1920 PROGRAM

(*Continued from page* 15)

profession, he continued. After lines of communication and transportation have been established, sanitary conditions improved and the possessions made habitable by technical men, then only can the administrative forces of government assume control.

General Wood explained that through the activity of technical societies several years before the World War, preliminary organization of the Engineer's Reserve Corps was effected.

LINN WHITE
Third Vice President

"You men should consider it one of the principal duties of your profession to, at all times, keep the Engineer's Reserve Corps filled with capable, loyal men. This corps must be kept one hundred per cent efficient so that in the stress of sudden emergency, America when called upon, can step into the breach with a minimum of uncertainty and confusion," he declared.

J. L. HECHT
Second Vice President

He was forced to leave the dinner shortly after his speech, amid applause for which echoed and re-echoed throughout the Cameo Room of the Morrison, to attend the convention of the Society of Automotive Engineers.

F. F. FOWLE, Treasurer

EDGAR S. NETHERCUT, Secretary

J. H. LIBBERTON, Trustee

A. Stewart Baldwin, retiring president, pointed out the need throughout the world today, of a more stern and conscientious application of the Golden Rule.

Civilization has, at certain well defined periods of the world's history, been subservient to barbarism because of infraction of this rule, he asserted.

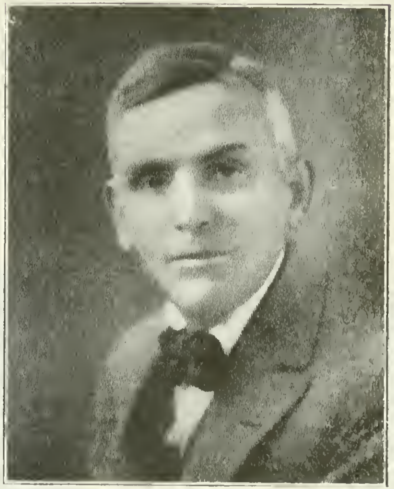
To prevent such debacles and to make civilization a permanent and desirable thing, the engineer must analyze the forces that today are a

A. F. RIGGS, Chairman
Electrical Section

ALBERT REICHMAN, Member
Washington Award Commission

PAST PRESIDENTS ON BOARD OF DIRECTION

H. J. BURT



C. B. BURDICK

A. S. BALDWIN

C. C. BOARDMAN, Chairman
Gas Section

menace to the peace and prosperity of the world and are directly antagonistic to this precept.

"Until we all can say," he declaired, "in our daily relationship with our fellow men, whether superior in rank or wealth, equal or subordinate, as to each one with whom we are thrown, 'What would I feel was just and right if I had been raised in the same environment, met with the same reverses and successes and learned to act accordingly?', the world must be filled with sorrow and contention, and the extent to which civilization will advance or recede will be in direct proportion to the extent to which that law of life is followed by mankind.

A. W. DILLING, Chairman
Bridge and Structural Section

"Good Will is the most potent and practical force that is at the disposal of the engineer for the accomplishment of great works. The world is in desperate need of it today, and I believe that when that force is fully and fairly recognized and used as a means to an end, the world will see works of magnitude and beauty so far in advance of those of today as to be beyond the present conception of man. If we make an honest effort to apply it in the work of our Society, we need have no fear as to what will be its history in usefulness, not only to ourselves and our profession, but to our fellow citizens at large."

Frederic P. Vose was at his best as toastmaster. Engineers and lawyers stand on common ground, he said, in that "strict economy" must be practiced diligently, while the profession must be considered of secondary importance, because of the proportionally small share of the world's goods received in return for services.

At one stage of the dinner it was the common opinion that he was going to call on the secretary for a few remarks, but he excused Mr. Nethercut by saying: "He discovered Lake Geneva and the University of Wisconsin views with pride and pleasure—no alarm whatever—the course he has pursued since leaving that institution."

The names of the officers for 1920, to be found on the inside front cover of this Journal, were read. A telegram of congratulations from W. B. Jackson, a past president of the Society, was received.

Community singing and music by the Universal Quartette were other features of the program.

Proper credit must be given Messrs. Dilling, Davis and PenDell, committee on arrangements for the excellent program prepared for the dinner. The guests expressed their approval by a rising vote of thanks to the committee.

Auspicious beginnings for the 51st year of the Western Society of Engineers have been made. The officers of the organization cannot do all. Every one must, with untiring energy, build with care and precision, an organization that stands for all that is best, according to the ethics of the engineering profession, in the municipality and nation in which we live.

(Editor's Note—The proceedings in full of the 50th annual dinner, together with the reports of the officers of the Society, will appear in the Technical Section in a later number of the Journal.)

The Rivers and Harbors appropriation bill was cut from $42,900,000, the estimate recommended by the Army Engineers, to $12,400,000 by the House Appropriations Committee. This waterways budget is the smallest carried in many years by the appropriation bill. Of the total appropriation $7,000,000 would be used for improvement work, $5,000,000 for maintenance and $400,000 for survey purposes.

WILLIAM ARTINGSTALL, Chairman Hydraulic, Sanitary and Municipal Section

Martin J. Kermer of Cannon-Swenson Company addressed the Detroit Engineering Society January 23 on the "American Beet Sugar Industry." Mr. Kermer has delivered this paper before the Western Society.

A. L. RICE, Chairman Mechanical Secton

E. T. HAWSON, Trustee

ENGINEERING EXPRESSION

(*Continued from page* 16)

And by writing about what interests their fellow men—by paying more attention to the "human-interest" element of life, especially as applied to professional matters—engineers may be expected to improve in their manner of expressing themselves forcefully and attractively on the printed page, and thus impressing themselves, perhaps, on their fellow men to a greater extent. It seems to me to be true that a warm interest in the everyday doings and problems of struggling humanity, with the earnest desire to help in bettering conditions and to exchange experiences, and the possession of a knowledge of English and of literary expression so that these sentiments may become known —it seems to me that this outlook on life and this activity will be of great value to all engineers, old and young.

But the engineer may say, "I cannot write; I have no taste for it." The answer to this is that if he is in earnest in being friendly to people, he will write, and if he is deeply in earnest he will write eloquently. There is nothing particularly mysterious or complicated in writing for publication. The main thing is to have something to say and to say it with such earnestness and good nature that the reader will be impressed. *Don't Worry About Style of Writing.*

A good book to read is *A Manual for Writers* by J. M. Manly, head of the Department of English of the University of Chicago, and J. A. Powell of the University of Chicago Press. In this book the authors say: "The number of persons who cannot under favorable conditions learn any craft is so small as to be negligible. * * * The craft of writing is no exception to this general rule. Any one who is willing to take the trouble to do so can acquire it." Observe that this refers to the *craft* of writing. Writing considered purely as an *art* is something different and is beyond the purpose of the present discussion."

Let me quote further from this excellent book:

"Many individuals * * * are seriously hampered in their efforts to write by the feeling that writing, especially writing for the public, should be something superfine, should be artificially, or at least artfully, decorated, that over the original form of their thought should be draped a beautiful garment called style. This is, of course, a thoroughly pernicious idea; it has not only prevented many from writing who might have written simply and agreeably, but, worse than that, has burdened the world with thousands of pages of that useless and bad product known as 'fine writing.' Fortunately 'fine writing' is now condemned by all who know, and teachers and writers unite in recognizing that style is not a matter of superficial decoration but resides in the very form in which the thought is conceived. Phrases that do not fit the thought are seen to disfigure, not to ornament it, and the remedy for a poor style is not fine words, but a better mode of thinking, just as the remedy for a feeble, shrunken body is not clothes but physical development.

"To write well is, in fact, to think or feel something worth saying, to give the thought or feeling clear and definite form, and then to say it in precisely this form. Every treatise on writing, therefore, must be, not a collection of tricks, but fundamentally a treatise on thinking. Anyone who has acquired the habit of thinking constantly, of mixing thought with his observations and emotions, of reflecting upon the likenesses and differences and causes of things, will have ideas in abundance, will be able to give them clear and definite form, and will need only practice and a few simple instructions to become a good writer."

One Engineer Who Wrote Well and Did Well.

That a man can be at once an engineer possessing the true scientific spirit and a litterateur and bibliophile is shown by the career of the late W. D. Weaver, for a number of years editor of *Electrical World*. Mr. Weaver graduated as a cadet engineer from the United States Naval Academy at Annapolis in 1880. After twelve years in the Navy as an engineering officer he turned to his true vocation, which was that of engineering writing and electrical journalism. In this he was very successful, to consider first merely material well-being, retiring in twenty years with a comfortable fortune. But, more than this, he gained the high respect of all American and many foreign electrical engineers and men of science, and he received the unprecedented tribute of having a tablet erected in his honor, during his lifetime, in the rooms of the American Institute of Electrical Engineers. Here was one engineer who knew how to write and who liked to write, and he had his reward.

W. W. DeBERARD, Trustee

It is true that Mr. Weaver was a remarkable man. He was not only an adept in the precision of science and of exact statement, but he had a remarkable faculty for the graphic, dramatic presentation of a good story. He could clothe a skeleton of hard, indisputable fact with the warm glowing flesh of human interest. What he has done showed that there is no conflict between exact accuracy of fact and the glow of real human sympathy.

It may be useful to mention here that in a letter written but a short time before his death (which occurred in November, 1919), and referring to the teaching of English in engineering schools, Mr. Weaver said: "It would be well if our technical schools were to add to their new course on the technique of composition the serious study of models such as Tyndall and Huxley, and, for condensed description, say, Ganot. In recently looking over a schedule of such a course, it seemed to me as mechanical in method as the teaching of machine design, with entire neglect of literary art."

Suggestions in Relation to the Preparation of News Copy.

In writing a news article or a news item, be brief but tell the story. Again I quote from Mr. Weaver, who, in speaking of the desirability of short articles, said: "This may necessitate sometimes packing ideas rather closely, but that, of course, rarely means a sacrifice of the reader's interests."

Be interesting. Be very accurate; stick to the facts; but endeavor to present them in a clear, vigorous, unhackneyed and possibly sprightly way. Try to put the essential feature of the "story" in the first paragraph. Put your best foot foremost. If you hold the reader's attention no farther than the first paragraph, be sure he gets your idea at any rate. Elaborate the details later.

Don't be afraid of a joke; few people that read your efforts are averse to a smile. Charles A. Dana, who was perhaps the greatest of American journalists, is reported to have said, "Tell it with a laugh." This does not mean that one should try to be funny; it does not mean being silly or trivial; but the idea is that if you can present some truth with a pleasant twinkle of the eye, as it were, you will not hurt yourself any in doing so.

One way to write is to make a beginning. Sam Blythe of the *Saturday Evening Post* says that "The way to write is to sit down and write." This applies particularly, of course, to news accounts, where you have the material at hand. But be sure of your facts. Accuracy is all-essential.

Where one is reporting the activities of a certain body or section or group at stated intervals it is a good plan to have a receptacle for notes, memoranda, clippings, etc., which may be jotted down or cut out as occasion arises and put away. Then at some specified time (say, for an hour twice a month in the case of the *Journal*) dive into this material, and with this aid the news will be set down in surprisingly short time.

Don't make a fetich of grammar. Write clearly, simply, intelligently, sympathetically; but don't be unduly alarmed at being ungrammatical. Ideas are more than words. It is of considerable importance to get the news; grammatical construction is less important. Somebody else can attend to that, if necessary. It is not meant to say one should be careless or slipshod in writing. The rules of etymology and syntax are of great value: they are useful to make the sense more clear; the sense—getting the message "across"—is more important.

What is news? Is it not what interests you and me? What interests men like ourselves? Does it not relate to the progress of science, art and inventions; to personal adventures and changes, to births, marriages and deaths, to ways of getting on in the world, to removals, to meetings and discussions, to the unusual, strange and the unexpected, and to everything else that happens? Is it not, in short, a transcript of life itself?

The demand for professional engineers is continuing on an upward movement. Less than one per cent of the total number of technical engineers in the country are actually out of employment at the present time. The demand is greater than can be supplied for a long time.

Average Revenue Per Ton Mile and Per Passenger Mile—Class One Roads

The increases in the average receipts per ton mile and per passenger mile during the past year as compared with 1914 and with intermediate periods are shown in the following table, issued by the U. S. Railroad Administration:

PERIOD	Average Revenue Per Ton Mile (Cents)	Average Revenue Per Passenger Mile (Cents)
Year ended June 30, 1914	.723	1.976
Year ended June 30, 1915	.722	1.979
Calendar year, 1916	.707	2.042
Calendar year, 1917	.715	2.090
Calendar year, 1918	.858	2.413
5 months ended May 31, 1918	.746	2.144
5 months ended May 31, 1919	.979	2.540
9 months ended September 30, 1919	.967	2.528
PER CENT OF INCREASE		
5 months ended May 31, 1919, over 5 months ended May 31, 1918	31.2%	18.5%
9 months ended September 30, 1919, over 5 months ended May 31, 1918	29.6%	17.9%
9 months ended September 30, 1919, over year ended June 30, 1914	33.8%	27.9%

Reformers cry: "Down with the profiteer." We are not as interested in downing the profiteer as we are in bringing down the high prices he has created.

CHICAGOAN HEADS NATIONAL BUILDING TRADES EMPLOYERS

Andrew Lanquist, Chicago contractor, was elected president of the reorganized National Association of Building Trades Employers, in session at Indianapolis, Ind. His election followed a unanimous nomination by delegates representing building trade employers' associations in every section of the country who gathered for the first annual meeting of the association.

The convention was in the nature of a second organizational meeting. The association was organized in Chicago last September with 150 delegates present from thirty cities, to deal more efficiently with the national labor problem. The employers' association was formed originally by a committee of the National Association of Builders' Exchanges appointed by the president at the national convention last February.

SALARIES INCREASED

Salaries of professors and instructors of the Northwestern University School of Engineering have been increased, retroactive to September 1, in response to the widespread movement throughout the country for an increase in teachers' wages.

Arthur E. Blackwood, formerly manager of the New York office of the Sullivan Machinery Co., has been named vice president in charge of finance; Howard T. Walsh, vice president in charge of sales; Gilbert K. Wilson, in charge of accounting; N. H. Blatchford, assistant treasurer, and Emil A. Krevis, general auditor. L. R. Chadwick has assumed the managership of the New York office and R. T. Banks will fill Mr. Chadwick's position in Spokane.

Half the troubles we complain of are troubles because we complain of them.

JOURNAL
OF THE
WESTERN SOCIETY
OF
ENGINEERS

"To promote and advance the science and art of engineering."

UNIT STUDY APPROVED

The Board of Direction on January 12 approved the recommendations of E. T. Howson, chairman of the Development Committee, that a committee be appointed to study subjects or classes of work to be undertaken by various committees of the Society.

Recommendations to this effect were made to the Development Committee by H. J. Burt and are the basis of the report of the committee to the Board. The original plan is published in another section of this Journal.

It is to be hoped that members of the Society will co-operate with the Board of Direction and this new committee. Surely this is a work that is much needed and now is the opportune time to put these committees or units in working order.

Our slogan during the Membership Campaign was: "Organize, Vitalize, Realize."

We organized and the results of that organization effort are apparent. Can we afford to let the team work lag?

We vitalized the campaign and those issues must constantly be worked upon to keep the interest of the entire membership at the highest pitch.

We realized in a material sense by securing more than 2000 new applications for membership in the Society. Shall we stop with only a material realization? No. We have added numbers to the Western Society and that makes it possible for us to develop the individual. Committee work is one of the greatest factors in this individual development.

Your assistance is needed in this great work. How many volunteers will there be for membership on these various committees that are to be formed? There should be fifty per cent of our membership at least.

A. I. E. E. JOURNAL

One result of the deliberations of the Committee on Development, American Institute of Electrical Engineers is the new Journal of the Society. The first appearance of the proceedings in this new form was January, 1920.

The new Journal has a nine by twelve inch page which allows for an attractive typographical display and a more pleasing arrangement of illustrations than is permissible on a smaller page.

Besides technical papers, which in the past have appeared in the proceedings, there are sections devoted to future meetings, A. I. E. E. news, employment service and current engineering topics.

Technical societies are realizing more and more that their publications must be used as a means of keeping the membership informed not only of the proceedings of the organizations but about news of immediate interest to the business life of the engineer. That was one of the many reasons for changing the style of the Journal of the Western Society.

All in all, the Journal of the A. I. E. E. appears to be one of the best technical organs in the country and it should exert a powerful influence, especially upon the electrical engineering profession.

A PLAN FOR INCREASING THE TECHNICAL WORK OF THE W. S. E.

The prospective large increase in the membership of the Society demands an organized system of activities that will be commensurate with the larger numbers. There should be some way of interesting and benefiting each member. To this end the following suggestions are offered:

Study Groups—

Arrangements should be made for organization of small sections, or groups, of either permanent or temporary character, for the study of specific subjects. Membership of these sections would be composed of volunteers who were specially interested in the subject in hand.

These sections would carry on their work in any manner they elect. It is suggested that their studies be carried on semi-privately leading up to an occasional public meeting or written report.

Some illustrations follow: Assume a group on the literature of reinforced concrete. All the literature on the subject could be assembled; all duplicate material eliminated; the mathematical accuracy and working limits of all formulas could be proved or disproved by mathematical investigation; examination of recorded experiments would determine what formulas are thus sustained; through the co-operation with laboratories arrange for making the needed experiments and finally prepare a report giving a descriptive bibliography of the literature, or better still, produce a complete text book on the subject. Continuing its work the unit could from time to time issue supplements, thus keeping the work up to date.

Assume a class in applied mathematics. A leader could be secured and instructions received in this subject in a way to apply it in every day work. Comparatively few engineers use their higher mathematics efficiently, simply because they have not learned to connect the abstract studies of college days with the practical work of later years. This would then be a post graduate course in applied mathematics, and might lead to the publication of more practical text books than are now available.

A certain group of men may be interested in studying the subject of *financing the construction and operation of engineering work.* They could secure from one of the universities, or elsewhere, a curriculum and carry on the study together. Instructors or lecturers might be employed by them if desired.

Illustrations similar to the foregoing might be multiplied to infinity.

Work of this character must be organized by the administrative body of the Society. It cannot be left to the initiative of individual members, at least not until the system is well established. In order to start it a special organizer should be employed; one who has had experience in University Extension work would be well qualified. Perhaps he would be needed only part of the time, or for part time. In the beginning he would doubtless be called upon to select subjects and hunt up interested workers.

The Society should furnish certain facilities, viz., committee rooms, library, secretarial service and publication service. It should give general supervision to the work and control the public meetings and the publications of the groups. It should take the initiative in organizing work on such subjects as may appear to be of importance and which have not been undertaken by individual initiative.

PUBLIC WORKS BODY MEETS IN CAPITAL

Engineers of Illinois have contributed $1,165 toward their quota of $6,500 for the support of the National Department of Public Works Association. The state of New York, with a quota of $10,000 has contributed $816.

This report was one of the outstanding features of the second convention held in Washington January 13 and 14, at which W. L. Abbott, M. W. S. E., represented the Western Society.

Mr. Abbott reports that much enthusiasm was displayed by the attending delegates and that the whole work for the establishment of the department is taking more definite form each day. One of the most satisfactory things about the convention, he declared, was the support members of congress are giving the movement.

There were 95 delegates in attendance, representing societies with a membership, eliminating obvious duplications, of 90,000.

Mr. Isham Randolph, M. W. S. E., representing the Franklin Institute and The Mississippi Valley Association, read an address from Governor Frank O. Lowden on "What a Department of Public Works has done for Illinois."

Congressman C. Frank Reavis, Nebraska, and Brig. Gen. R. C. Marshall addressed the delegates at one session.

The committee on New Organization recommended that the scope of the Association be enlarged. Committees are to be established in every state to push the work. The entire report was approved.

On the question of finances, it was urged that each participating society assess their members at least one dollar per man. In this way $90,000 would be raised to carry on the work of the Association.

LONDON CORRESPONDENCE

NATIONAL CONGRESS OF BELGIAN ARCHITECTS

By W. E. Woolley.

The ninth National Congress of Belgian Architects was opened December 14, 1919, at the Palais de la Bourse, Brussels.

The President, M. Mankels, referred to the part played by Belgian architects during the war.

It was decided to request that the Minister of the Interior create a Committee of a limited number of architects representing the devastated regions, which should take over works already begun. Is it necessary to rebuild Ypres as it was before the War?

Economic conditions have changed; the destroyed towns cannot be as they were. Plans and the procedure of reconstruction should be adopted to the exigencies of modern life and social evolution. A lapidary or monumental museum should be formed of the most interesting debris. Some facade types should be rebuilt, but the reconstruction of Ypres should be approached in a spirit frankly modern.

Dear Editor:
I Hope You
Enjoyed
The Annual Dinner As
Much As I Did.
Hasn't That Man Vose
A Wonderful Memory?
'The Way He Took The Speakers,
Started Back At Their
Birthplaces,
And Told All The
Important Details Of Their
Lives Right Up
To The Moment
Of His Introduction,
Was Truly Awe Inspiring.
And Wasn't It Lucky
That Libberton's Songster
Came Out With His Song
And Sounded The Keynote
Of The General's Speech?
The General
Would Have Talked Anyhow,
But It Was Nice of Libberton
And His Gang
To Help Him Out As They Did.
Remember To Get Me A
Copy Of
Mr. Baldwin's Speech.
It Was Great.
And I Want
To Read All
The Fine Print
Some Quiet Evening.
Seems To Me That All
The Old Timers
Won't Know The New
Western Society
Unless They Start Coming
Around Quick
And
Keep Coming Around Regular.
Mr. Copeland
And His Cabinet
Got A Good Start
Didn't They?
Let's Wish 'Em Luck,
You and Me.

P. E. G.

February 5, 1920

ANNOUNCEMENT

The Journal of the Western Society wishes to announce that M. W. E. Woolley, London, will act as European correspondent for the Journal and will keep members of the Society informed of engineering news of interest in the British Isles and on the continent.

Mr. Woolley is an associate member of the American Society of Civil Engineers.

The 26th annual meeting of the American Society of Heating and Ventilating Engineers was held in the Engineering Societies' Building, New York, January 27, 28, 29. All papers were read in abstract, the papers being published in the October and January numbers of the Society's Journal. A special program was also prepared for the wives of attending delegates.

The Edmund T. Perkins Engineering Company, consulting and supervising engineers and specialists in land reclamation, have announced the centralizing of all branch offices at 1210-56 First National Bank Building, Chicago.

ENGINEERS IN POLITICS

Engineers of this country can and will be prime movers in effecting improvements in methods of government. Science must be applied to the solution of economic problems. Many problems of municipal and federal government are identical to the ones engineers are accustomed to solve. Why then, should not all engineers enter this field of "political engineering"/ How far they should go depends entirely upon the success they make of the venture.

The Illinois Society of Engineers met in annual meeting at Urbana, January 21-23. Notable among the papers presented was that on "Desplaines Activated Sludge Plant," by Langdon Pearce, M. W. S. E.

EMPLOYMENT SERVICE

NO CHARGE is made for opportunities announced in this section of the Journal.

ANNOUNCEMENTS must not be more than sixty-five words in length and will not be inserted more than twice during a period of two months, during which time all records will remain in the active files. All correspondence will be treated confidentially.

APPLICANTS for situations, not members of the W. S. E., must have card of introduction from a member of the Society.

ALL REPLIES should be addressed to the key number indicated, in care of Employment Bureau, Western Society of Engineers, 1735 *Monadnock Block, Chicago.*

SITUATIONS WANTED

CAPTAIN ENGINEERS, GRADUATE M. E., five years consulting and contracting engineer, wants executive position. Age 40. Salary expected, $5,000. References on application. Address B-102.

CIVIL ENGINEER, eight years experience, wants position as construction superintendent or inspector. Age 31, single. Salary $200 to $250 per month. Address B-103.

GRADUATE M. E., age 40, married, desires position as factory superintendent or production engineer. Now in employ of U. S. government. Address B-104.

GRADUATE C. E., twelve years experience in design, detail and estimates for bridge and building structures of steel and reinforced concrete, wants position as superintendent of construction. Age 32, married. Salary $250 to $300 per month. Address B-105.

GRADUATE CRANE TECH., age 24, single, desires situation with industrial concern, contractor or consulting engineer; salary considered secondary. Address B-106.

GRADUATE ELECT. ENGR., age 27, married, wants position as power plant engineer or work in connection with industrial plants. Salary $300. Address B-107.

GRAD. RY. ELECT. ENGR., 11 years experience elect. and mech. construction; age 33, single; salary $3,000. Capt. U. S. A. 2½ years. Address B-109.

GRAD. M. E., four years experience, desires position where executive ability is required, eventually leading to executive responsibilities. Salary $2,600 to $3,000. Address B-110.

ENGINEER desires position with railway supply house. References furnished. Address B-111.

GRAD. C. E., married, ten years experience editorial and construction work, wants position as editor of construction paper, manager concrete products shop or construction expediter. Address B-112.

YOUNG MAN, 3½ years mechanical draftsman, wants position for machine designing. Salary $140. Address B-113.

GRADUATE C. E., two and a half years experience, now employed by western railroad as designer and estimator, wants position outside of railroad field. Age 28, single. Address B-114.

CHEMICAL ENGINEER, is fitted for position as salesman or adjuster for firms selling chemical machinery. Salary plus commission. Wants opportunity to show initiative. What have you? Address B-116.

EXPERIENCED E. E. wants position as executive with public utility corporation. Best of references. Salary $2,000 to $2,500. Address B-117.

ENGINEER with experience in supervision of field construction accounting offices, now with U. S. Housing Corporation, desires change of location. Salary $3,500. Address B-118.

I WANT A POSITION in sales engineering department of concern manufacturing electrical equipment. College graduate. Twelve years experience. Salary expected $3,600. Address B-121.

MECHANICAL ENGINEER, 25 years experience, wants to change position. References on application. Salary $3,600. Address B-122.

ELECTRICAL ENGINEER, experienced in supervision of electrical layouts for power plants and substations, industrial buildings and overhead and underground distribution, wants to change position where greater opportunity is offered. Salary $3,000. Address B-220.

CAPT., U. S. A., experienced in concrete construction, sewerage, water supply and drainage, wants position with industrial concern. References on application. Address B-221.

MAJOR ENGINEERS, U. S. A., recently discharged—now employed—is familiar with all phases of construction projects; desires position as supt., office executive or sales engineer. Good organizer. Address B-222.

CIVIL ENGINEER wants position with commercial organization where technical training will be of value. Experienced as construction executive. Address B-223.

GRAD. MASS. INST. TECH., desires position with manufacturing concern requiring services of mech. engr. in developing and originating specialties, planning methods and systems. Experienced in design of cranes, hoists and general equipment. Address B-224.

CIVIL ENGINEER wants to identify himself with organization engaged in engineering research or construction or with firm manufacturing commercial product requiring engineering services. Experienced in valuation work. Address B-225.

GRADUATE ARMOUR INSTITUTE, experienced in construction and estimating, wants position that will develop into sales engineering work. References on application. Address B-226.

MAN EXPERIENCED in field engineering and direct charge of important construction wants position as field engineer. Best of references. Address B-228.

ENGINEER who considers salary of secondary importance wants position with machinery manufacturer in Chicago. Recently discharged from army. Address B-229.

MAJOR ENGR'S., U. S. A., with general engineering experience, wants to locate in Chicago. What have you to offer? Address B-230.

ENGINEER wants position in Montana or Wyoming. General experience. Address B-231.

ENGINEER now employed by government desires position with industrial organization. Must increase income. Address B-232.

WHAT HAVE YOU TO OFFER in structural engineering, drafting, designing or estimating lines to an engineer of varied experience now employed by large Chicago corporation? Address B-233.

EMPLOYED IN DIVISION ENGINEER'S OFFICE, western railroad; wants position in West, preferably Arizona. References on application. Address B-234.

ENGINEER, civil, wants opportunity to increase income and broaden experience. References. Address B-235.

SITUATIONS AVAILABLE.

FOUR MECHANICAL ENGINEERS needed at Ford Plant, Detroit. Ideal conditions. Address A-1.

WANTED—TWO DESIGNING ENGINEERS, experienced with reinforced concrete and TWO MECHANICAL DRAFTSMEN. Address A-2.

WANTED– SALES ENGINEER with large organization in city. Address A-3.

WANTED—MECHANICAL DRAFTSMAN experienced on car work, preferably engaged in past in steel or malleable iron foundry. Address A-4.

MAN experienced as cost engineer to work on public service and municipal accounts is needed by large organization of industrial engineers. References required. Salary commensurate with ability. Address A-5.

WANTED—ONE MECHANICAL DRAFTSMAN and ONE MECHANICAL ENGINEER to make efficiency tests of boilers. Needed at once. Address A-6.

ONE STRUCTURAL DESIGNER, TWO GENERAL DRAFTSMEN, ONE SANITARY ENGINEER, first class only, wanted by waterways commission. Address A-7.

WANTED — CHIEF DRAFTSMAN familiar with reinforced concrete design. Salary reasonable. Address A-8.

RESPONSIBLE COMPANY wants high grade sales engineer. One who has had stoker experience. Address A-9.

WANTED — INSTRUCTOR IN SURVEYING in school of engineering near Chicago. Salary $1,400 to $1,800, depending upon experience and ability. Address A-10.

WANTED—ENGINEER who has had experience with heating and ventilating plants to handle sales of hot air heater for factories and large offices. Address A-11.

RESPONSIBLE ARCHITECTURAL FIRM wants experienced concrete engineer familiar with design of buildings. Address A-12.

WANTED—MAN 25 TO 30 YEARS OF AGE to take position as superintendent in electric lighting plant in Iowa. General superivision of office and system. Salary about $175, depending upon man. Address A-13.

WANTED—BUSINESS CONTRACT AGENT for electric light plant in city of 50,000, 200 miles of Chicago. Salary $200, depending upon qualifications. Address A-14.

TECHNICAL SECTION

JOURNAL OF THE
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Wood Block Paving

By WALTER BUEHLER, M. W. S. E.

Presented December 22, 1919.

AN inspection of the creosoted block pavements in the loop district of Chicago today might result in the conclusion: "Why creosoted block pavements at all?" A more careful investigation of the history of these loop pavements will, on the other hand, convince any impartial investigator that these pavements have been an economic investment.

Sometime ago I prepared a statement showing all the loop pavements; with the yardage and year in which they were constructed. From this statement I found that practically fifty per cent of the total yardage is at least nine years old, the oldest pavement, Monroe Street, Clark to Dearborn, being twelve years old.

Conditions in the loop district are especially severe, not only from the standpoint of traffic, but from the fact that practically all streets have double street car tracks, and what is probably worse, the streets are constantly being torn up for one reason or another. Even under these adverse conditions the wood block pavements in the loop have not by any means outlived their usefulness.

Notwithstanding this showing, and a good many similar, the use of wood block pavements in Chicago and generally is falling off. A few cities, like Minneapolis, still continue to use them, but as a general rule the wood block pavement does not seem to be as popular today as it was five years ago.

Why this condition exists I am not prepared to say; probably the high cost of the pavement today has something to do with it. Probably the increasing demand for preserved wood for other uses has been more attractive to the wood preservers, resulting in a letting down of their selling effort of wood block pavements. Whatever the reason is, the fact remains that not as much wood block pavement is being laid today as five years ago.

Personally I believe this is unfortunate. First, for the reason that even under the handicap of faulty treatment and construction the wood block pavement generally gives good service. Now with the more scientific treatment and better construction it should give even better service. Secondly, even though the cost is high today, it is not relatively higher than the cost of other types of pavements, with which it can be compared, while the improvements in the past five years in the manufacture of the blocks and the construction of the pavement exceed any similar improvements in any other type of pavement.

To understand the newer developments in the wood block pavements it will be necessary to sketch briefly what has been the practice in the past. In doing this I will not take the time now to go back very many years in the history of block pavements, as the real developments have occurred in the past ten years. These developments have been along the lines of refinements in the manufacture of the block and details in the construction of the pavement. And all of them have had as their objective the illumination of what have been the two principal defects in wood block pavements, namely, expansion and bleeding.

About ten years ago the general practice was to treat blocks with sixteen pounds of creosote oil per cubic foot of timber and lay them on a concrete bed with a sand cushion between blocks and base. At that time the principal difficulty was the excess expansion experienced right after the pavement was laid, or after three to five years. There were no standard specifications in existence then, each city apparently working independently of every other. There seemed, however, to exist the general impression that expansion was caused by improper waterproofing the blocks during treatment. Dozens of different kinds of oil were specified. There were advocates of light oil and of heavy oil. Some thought sixteen pounds of oil was enough; others that twenty pounds should be used. In other words, it was generally thought that either the proper quality or the proper quantity of oil would waterproof the block and prevent swelling. For illustration, the standard creosote block paving specification adopted in 1911 by the Association for Standardizing Paving Specifications called for twenty pounds of oil per cubic foot of lumber, and the oil could contain an unlimited percentage of tar. The condition of timber before and during treatment and the method to be employed in injecting the oil were barely mentioned.

The essence of the specification clearly was the quantity and quality of oil to be injected. As a direct result of the adoption of this specification by a great many cities and the manufacture of blocks thereunder, a new difficulty was soon heard of, one in a great many respects worse than expansion. That was bleeding. Immediately a new flood of opinions brook loose. Blocks were being treated too heavily. It was all wrong to use heavy oil. It was all wrong to permit the use of tar. Again all the difficulties were attributed to quality or quantity of preservation.

In view of fairly recent developments, what are the facts? How can expansion be eliminated? How can bleeding be prevented? To understand expansion and its prevention, it is necessary to have an understanding of the physical structure of wood. Southern pine, which is the wood most generally used in the central west and esatern sections, is, as you no doubt know, made up of elongated spindle-like fibres, closed at the ends and having hollow centers. The walls are pierced with small openings. Now it is an interesting and important fact that the cell walls will not absorb creosote except in very small amounts. While on the other hand they will absorb water, and in fact it is the water content of the fibre wall that has a direct bearing upon the contraction or expansion of the wood.

A saturated piece of wood is expanded to its maximum. As moisture is evaporated no change in size takes place until the moisture is out of the cell structure, or hollow spaces in the fibres and begins to come out of the fibre wall itself. This point is called the fibre saturation point. Any decrease of moisture in the cell wall will immediately result in contraction. A creosoted block therefore contains more or less moisture in the cell walls, depending upon its seasoning before treatment, and creosote oil in the cell openings.

The creosote oil in the cell openings and on the cell walls acting as a water proofing paint, retards, not entirely preventing, the evaporation or absorption of moisture. A heavily treated block exposed to the sun will lose enough moisture to appreciably contract and will when again subjected to moisture absorb it and expand. A block treated to refusal, which in southern pine might mean twenty-eight pounds per cubic foot, would of course be more waterproof than one treated with sixteen pounds per cubic foot. But as the creosote acts as a paint, it is not necessary or advisable to have a surplus of oil in the cell openings, approximately the same effect being produced by a uniform distribution of a smaller quantity of oil. In other words, it is better to regulate the treatment so as to get a better distribution of a small quantity of oil than to specify a large quantity, the larger quantity tending to produce bleeding. Sixteen pounds of oil per cubic foot of timber has been determined to be the most economical amount.

Now as to the effect of quality of oil on expansion. It goes without saying that the heavier the oil, the better water-proofing paint it will be. The heaviness, however, is limited by the necessity of uniform distribution throughout the wood and the practical time limit required to obtain this uniform distribution. Again it resolves itself into a question of treating methods rather than quality of oil.

Now just what are the treating methods to which I refer? They can be stated briefly. First, the preparation of the wood for the injection of the preservative. Second, the proper injection of preservative, regulating both the time and amount of pressure; and thirdly, the cleaning of the surface of the blocks by steam and vacuum.

The specifications for treatment as adopted by the American Wood Preservation Association reads as follows: "Timber may be either air seasoned or green, but should preferably be treated within three months from the time it is sawed. Green timber and seasoned timber shall not, however, be treated together in the same charge. The blocks shall be treated in air-tight cylinders with the preservative heretofore specified. In all cases, whether thoroughly air seasoned or green, they shall first be subjected to live steam at a temperature between 220 and 240 degrees Fahrenheit, for not less than two hours nor more than four hours. Afterwards they shall be subjected to a vacuum of not less than twenty-two inches, held for at least one hour. While the vacuum is still on the preservative, oil heated to a temperature of between 180 degrees and 220 degrees Fahrenheit, shall be run until the cylinder is completely full, care being taken that no air is admitted. Pressure shall then be gradually applied not to exceed fifty pounds, at the end of the first hour, nor one hundred pounds at the end of the second hour, and then maintained at not less than one hundred pounds, nor more than one hundred fifty pounds, until the wood has absorbed the required amount of oil. After this a supplemental vacuum shall be applied in which the maximum intensity reached shall be at least twenty inches, and shall continue for a period of not less than thirty minutes. If desired, this vacuum may be followed by a short steaming period."

Now the important factors in this specification, as outlined, are: First, the condition of timber before treatment. It states that the timber may be either air seasoned or green, but in either case it shall first be subjected to live steam at a temperature between 220 and 240 degrees Fahrenheit, for not less than two nor more than four hours. Now, have in mind that this specification was drawn up with the object of obtaining a uniform distribution of the oil in the block—and that southern pine can be impregnated with about twenty-eight pounds per cubic foot—and we are trying to impregnate it with sixteen pounds of oil to the cubic foot, approximately half the amount—and uniformly distribute that smaller amount throughout the block. If the blocks were all thoroughly seasoned and the oil injected in that seasoned condition and the treatment stopped at sixteen pounds of oil per cubic foot, we would then find the sap wood thoroughly saturated and the heart wood barely treated. In other words, thoroughly seasoned, the sap wood is far less resistant to impregnation than the heart wood. On the other hand, if the timber were green and not steamed to permit of the impregnation of the sap wood, the sap wood, which is saturated with moisture and in a green state more resistant than heart, would receive less oil and the heart wood receive more oil, resulting in the rotting of the sap wood, so that it is important that whether the timber be seasoned or green, that it be first steamed in order to, in a measure, equalize the resistance of both the sap wood and the heart wood. Then of course, after the steaming period, it calls for the vauum, which is simply to remove the surplus moisture from the block. Then follows this clause: "Pressure shall then be applied after the cylinder is filled with oil gradually, not to exceed fifty pounds, at the end of the first hour, nor more than one hundred pounds at the end of the second hour." That is one of the most important clauses in the specification. If a high degree of pressure were applied rapidly, the sixteen pounds of oil per cubic foot, which is approximately half the quantity which could be injected, would go into the less resistant blocks, treating them more heavily than the more resistant blocks, and it would also fill the outer surfaces of the block and not be uniformly distributed throughout the block, so that the two factors: first, putting the wood in condition for impregnation and then the uniform pressure slowly applied are both essential to a uniform distribution. The third clause, steaming and vacuum, are not absolutely necessary, but if an oil has been used repeatedly it accumulates more or less sawdust and dirt, and a clearer block will result if the steaming and vacuum practice is followed. In other words, it has a washing effect.

Careful observance of the specifications just described is the only preventive for bleeding.

As I have already stated, we first heard of bleeding about the time of the adoption of the heavy oil and heavy treatment specification by the Association for Standardizing Paving Specification.

This specification ignored the importance of proper treatment, and as a result manufacturers, working always to increase the capacity of their cylinders, simply increased the pressure and applied it as rapidly as possible to offset the greater difficulty of forcing in the greater quantities and heavier oil, practically producing a block with oil very unevenly distributed, most of it near the surface of the block or crowded into the heart or sap wood, depending on the condition of timber during treatment. Naturally that block, when exposed to atmospheric pressure and expansion in the pavement, would bleed. The oil uniformly distributed is not in sufficient volumes near the surface of the block to cause bleeding.

As stated, the early practice was to lay the blocks on a concrete foundation with a sand cushion between the blocks and the foundation. In the past seven or eight years, most of the cities using blocks to any extent, used a mortar cushion; that is, instead of straight sand, a mixture of four parts sand and one part cement, moist enough to spread easily. This form of construction is a big improvement over the sand cushion construction, but there is still the objection that this mortar cushion is sufficiently porous to hold moisture which is absorbed by the block from the bottom and causes expansion. It removed the objection of shifting cushions; for example, in St. Louis, where a very fine Mississippi River sand was used for cushions, it would shift very badly.

The so-called bituminous paint method of construction consists of an even concrete painted with a thin bituminous paint coat, not exceeding an eighth of an inch thick, and the block laid directly on this paint coat. This construction is not by any means new in this country or abroad. It was practiced abroad ten or twelve years ago. It was practiced in parts of this country, in isolated cases, ten years ago. There is a sample of it in St. Louis, also across the Canadian line in a little town called St. Boniface. The earlier types of this form of construction consisted in laying the blocks in a hot bituminous paint coat. In other words, the paint coat was applied at the same time the block was laid. The practice now is to lay the block on a cold paint coat. After the concrete is painted, the paint coat is allowed to cool and then the blocks are laid on the cold paint coat. This has the advantage of permitting an inspection of the surface of the block before the pavement is filled. When laying the blocks in a hot bituminous cushion, it is almost impossible to remove any of the blocks for final inspection. After the block is laid, rolling is sometimes specified, but it is not absolutely necessary, as a short time after it is laid it adheres to the paint coat, which effectually seals the bottom. The object of the paint coat is not to take care of any irregularities in the surface of the concrete, but it is to seal the bottom of the block. It is therefore necessary to have a fairly smooth and even concrete upon which to lay the blocks.

About two years ago, when this method of construction was first suggested as a standard, there was considerable objection, principally from contractors, who claimed it would not be possible, economically, to produce a smooth enough concrete to lay the blocks directly upon. It was thought that it would be necessary to provide a sidewalk finish. It was found, however, that this was not necessary. In fact, if a concrete base proportioned about one to two and one-half to five, which provides enough mortar to permit of finishing, is worked the same as a one course concrete pavement, and finished with a long handle float or a small roller, a sufficiently even surface can be produced.

In Minneapolis, where this construction is standard, the engineer in charge uses a three-inch pipe, about fifteen feet long filled with sand, operated on wooden templets—the top of the templets to the grade of the finished concrete. He gets an even surface—not necessarily a smooth surface, but he gets an even surface and he gets it rapidly and cheaply.

It has been found that where this method of construction is compared with the mortar bed construction, that it is cheaper, for the reason that the elimination of the mortar bed results in a saving in sand and cement that more than offsets the cost of the thin coat of bitumen and labor of preparing concrete. One city has effected a saving of from ten to fifteen cents a square yard.

The bituminous paint coat sealing the bottom of the block is one more step in water-proofing the block. In addition it is necessary to fill the joints of the pavement in order to seal the sides of the block.

Sand filled streets have in some instances given satisfaction. Generally, when this is the case, it is found that the traffic is sufficiently heavy to broom over the surface of the blocks and keep them in a fairly constant waterproof condition. For example, in the loop district here in Chicago a sand filled block would give far better service than out in the residential sections, although even in the loop district of Chicago it is not advisable.

With one exception there is no paint coat construction in Chicago. The exception is a short stretch on Dearborn Street, between Adams and Jackson, in front of the post office, on the west side of the street, put in by the city. There is a marked difference between this sample and other loop pavements laid the same length of time. This pavement has been in about nine years.

While the block for street paving is apparently not as popular today as it was four our five years ago, the block for interior factory floor construction is far more popular; in fact I believe I am safe in saying that there are more wood block interior floors being laid today than there are wood block streets, i. e., a greater yardage of blocks on interior floors than on streets.

A wood block for an interior floor must receive an entirely different treatment than the block to be used in paving a street.

The interior block is laid in an environment which will be constantly dry, therefore tends to contract, while of course the exterior block tends to expand; so it is important that the blocks for interior purposes be thoroughly seasoned before it is treated and before it is laid.

Now in order to equalize the distribution of oil in an interior block treatment, it is necessary to treat the block to refusal and then to withdraw the surplus oil by one of the empty cell processes. There are two of these in general use. One, the so-called Rueping process, and the other the Lowry process. The Rueping process consists of subjecting the wood to an air pressure of say one hundred pounds; then while under that pressure to an oil pressure of approximately two hundred pounds. One hundred pounds equalizing the effect of the air pressure, the additional one hundred pounds forcing the oil into the wood. Upon release of the oil pressure, the compressed air within the wood expands and forces out the surplus oil.

The Lowry process consists in taking advantage of the air already contained in the block. The cylinder is completely filled with oil, and pressure applied very rapidly against the air in the block without a preliminary vacuum, and then advantage is taken of the expansion of the contained air upon release of the oil pressure to blow out the surplus oil. By this method the interior blocks are treated with about four to eight pounds of oil per cubic foot. Both of these treatments are also commonly used in the treatment of railroad ties.

I now desire to show a few slides illustrating the construction of wood block pavements by the paint coat method. I might say that even with the improved treatment, we still hear of bleeding, but most of the cases of bleeding you will find are probably due to excessive use of filler. The practice of filling the joints between blocks with pitch—simply smearing the pitch back and forth on top of the block—results in a surplus amount of filler on top of the block, which during the hot weather gives the impression of bleeding. If the filler is properly applied—if it is heated to the proper temperature and then poured on the pavement and squeezed in one direction only—not mopped back and forth—the joints of the pavement can be filled from one-third to one-half full. The pitch, upon cooling, contracts, and the filler remains about an inch from the bottom, which is sufficient, for the object of the filler is not to fill the space between the block, but is to paint the sides of the block and a small amount in the bottom of the joint, upon expansion is squeezed up, and there is enough there to paint the sides of the block.

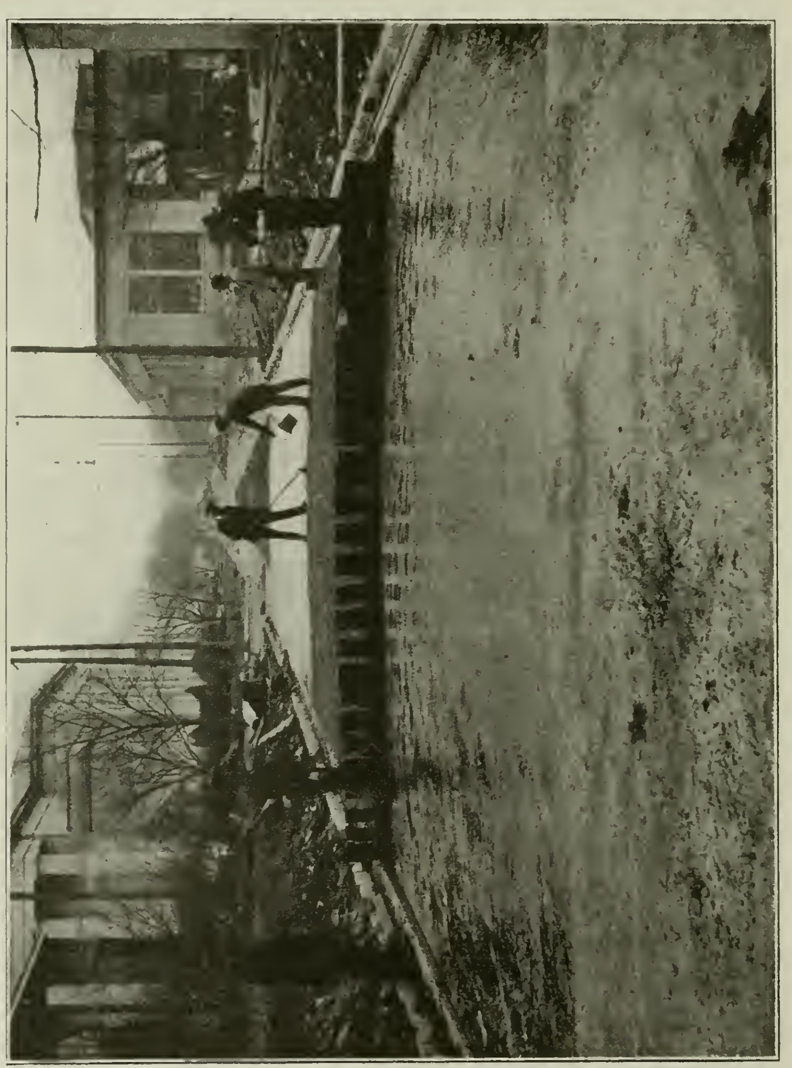


Fig. 1

Figure 1 illustrates the paint coat method of construction. The smooth concrete and the bituminous paint coat are in the foreground and the blocks laid directly upon the paint coat.

This picture was taken in Dayton on the grounds of the National Cash Register Company.

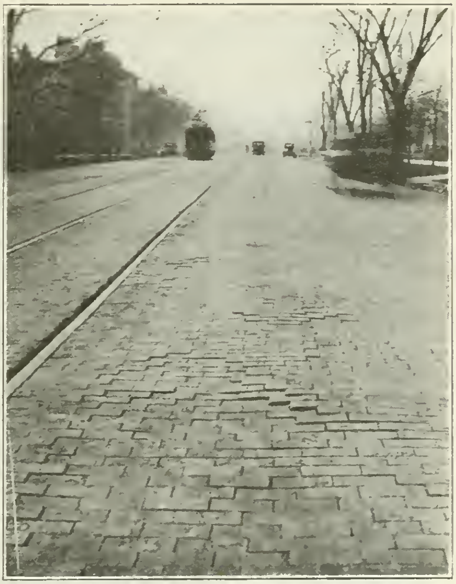


Fig. 2

Figure 2 is an illustration of a poor job of filling the joints. This picture was taken on Euclid Avenue in the City of Cleveland less than six months after the pavement was laid. This particular block was the so-called "Lug" block. The condition illustrated is not caused by the fact that a lug block was used, but by method used in filling the joints. The method employed was first sweeping in sand and then filling with pitch, and then sand. The theory being that the first application of sand would partially fill the joints and prevent the bituminous filler from running down under the blocks. Practically what happened was to fill the joints completely with sand, resulting in a sand-filled street and not a bituminous filled

Fig. 3

street. Some of the blocks taken up to make repairs showed absolutely no evidence of a bituminous filler ever having been applied.

A very common method of applying filler is shown in Figure 3.

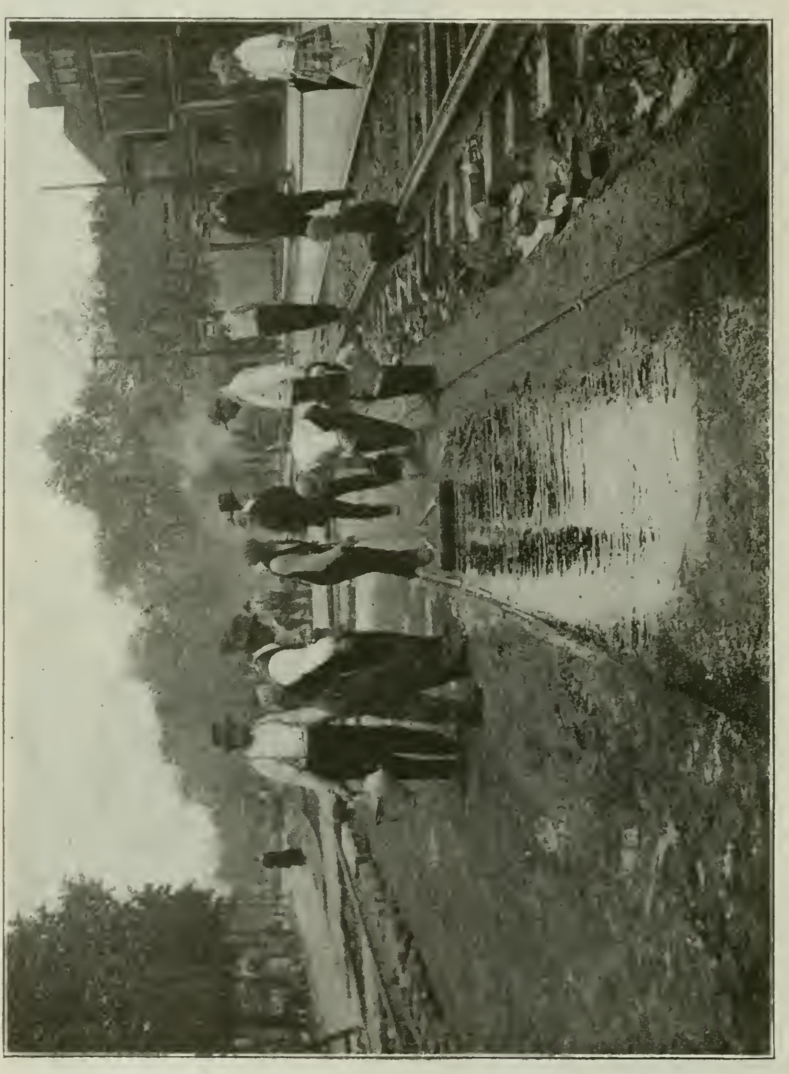


Fig. 4

It is a poor way to apply filler, for the reason that it results in a surplus of filler in the joints and on the surface.

Figure 4 illustrates another unsatisfactory way of applying a filler, attempts having been made to first clean the surface of the pavement. It is of course very necessary that the surface of the pavement be thoroughly cleaned before the filler is applied, otherwise it remains on the surface of the pavement, very little going down in the joint.

The manner in which filler should be applied is shown in Figure

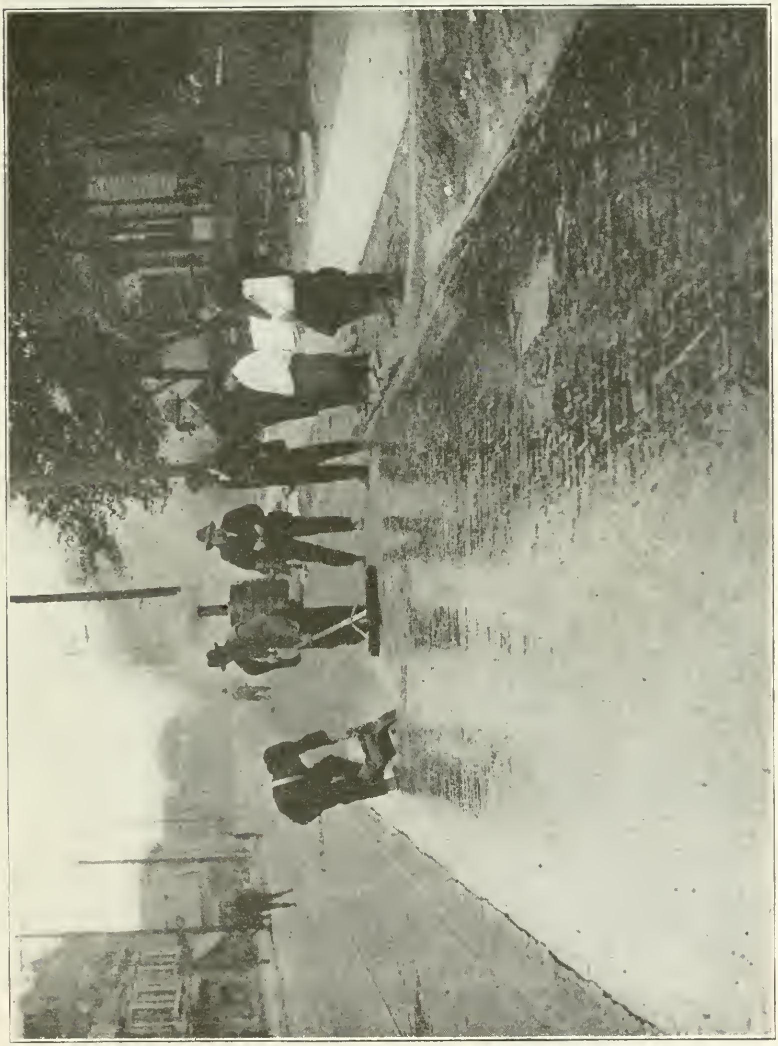


Fig. 5

5. You will notice in the foreground that practically all the joints of the pavement can be seen. The surface of the blocks is clean, in fact it was sufficiently free from pitch directly after application, that the sand covering, under traffic easily absorbed what little surplus pitch there was. The joints were about a third full, only a small amount of filler was used at one time and squeezed in one direction only.

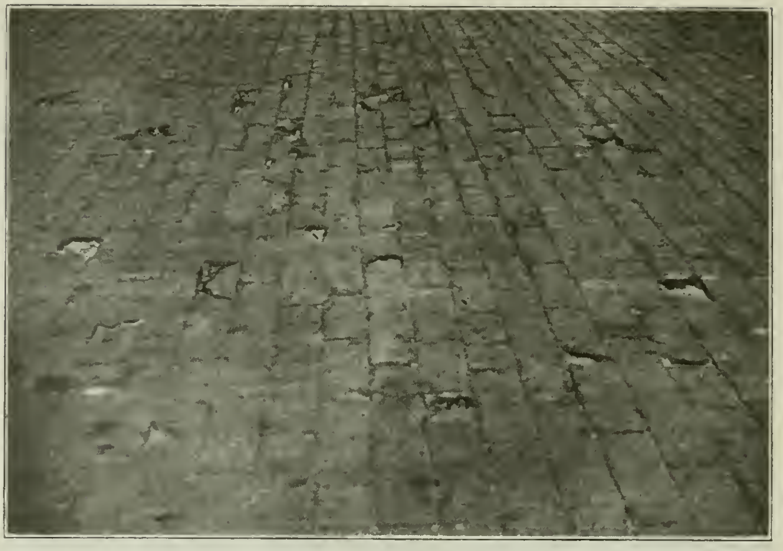


Fig. 6

Figure 6 shows a case of poor distribution of preservative impregnating the block. Evidently the block was treated green and the heart wood received the oil, the sap wood being wet not receiving the oil. The sap rot is very evident. Wherever you see a depression it is always sap wood. I have seen cases where just the reverse would be true; in other words, cases where the block was evidently thoroughly seasoned before treatment.

So much stress has been laid upon quality and quantity of oil that should be used that it has only been within the past two or three years that proper recognition has been given to the quality of treatment. The quality or the quantity of oil are minor considerations when compared with the quality of treatment.

DISCUSSION.

Mr. White: This is a subject in which I know quite a number are very much interested and I think a discussion is in order.

Mr. Cleveland: In this paint coat construction, where you use only about one-third to fill the cracks; first, do you use a sand coating over that so that it will absorb the excess oil?

Mr. Buehler: Yes.

Mr. Cleveland: Well, after these joints fill up with sand, don't you find trouble with the sand resisting the expansion of the block?

Mr. Buehler: The expansion of the block, as I have tried to explain, is due to the moisture content of the block. If the block is uniformly treated there will be little expansion, yet if a green block is stacked up along a job for two or three weeks in the sun before it is laid it contracts. Then if it is laid without first thoroughly wetting it, and sand is poured in between the joints, expansion might occur. An expanded block with the joints filled with bitumen retains the moisture and remains expanded. The bituminous filler in the joints simply paints the sides of the block and acts the same as a waterproofing paint.

Question: Is it customary to use paint coat construction on interior work? What are the commercial sizes of the blocks?

Mr. Buehler: Yes, it is. In building construction where the general contractor puts in the concrete floors it is sometimes difficult to get a smooth enough floor. It is a peculiar proposition that it is harder to get a building contractor to lay a smooth enough floor to lay a block on, than it is a street contractor. I don't know why that is, but it is a fact. If the floor is rough, you must first build it up with a mortar bed, in order to smooth it up, and then use a bituminous paint coat. If the floor could be made even enough to lay the block directly on the paint coat, of course that is the best practice.

The sizes for interior work generally are three inches—in some cases two and a half inches in depth. The width and the length of the block are not so important, although they must all be uniform in width, whether it be three or three and a half or four inches. A two and a half inch block laid on bituminous paint coated concrete is, in my opinion, heavy enough for practically all uses.

Member: Do you use the same kind of oil for interior work as you do for outside work? I imagine the odor might be objectionable.

Mr. Buehler: As a general rule, yes. The standard specifications provide for two kinds of oil, one a mixture, including refined tar, limiting the percentage of tar to 35 per cent, and the other a straight distillate oil. The mixture is cheaper than the distillate, and is more generally used. The odor is only pronounced during the first few weeks and is not objectionable.

Question: The specifications referred to—the American Wood Preserver specifications—do you consider them the best specifications now for use on creosoted paving blocks?

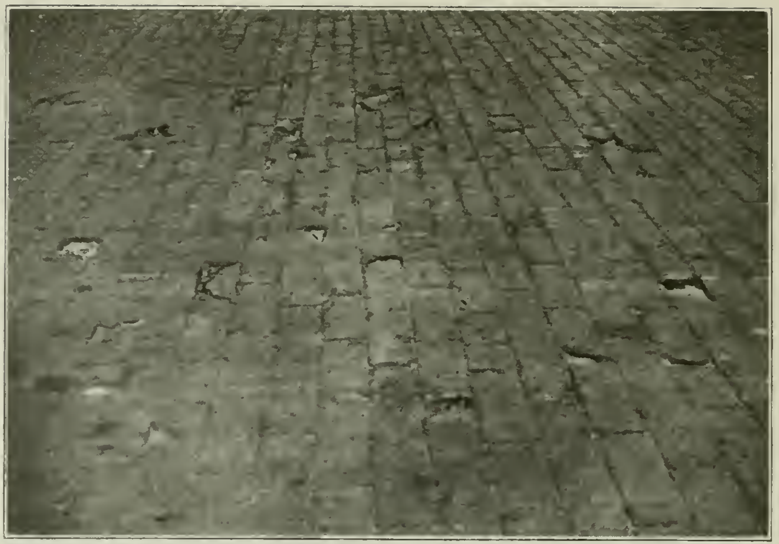
Mr. Buehler: It happens that the American Wood Preservers' specifications are the same as those adopted by the American Society of Municipal Improvements, and also by the American Society of Testing Materials, and is generally accepted as the best specification.

Question: Have you been in St. Louis lately?

Mr. Buehler: Yes, in the last month or so.

Member: Well, in connection with filling the joints one-third of the way up and then permitting the expansion of the blocks to take care of. Now, on McPherson just east of Euclid Avenue that was tried out this summer. It was put in in the summer and when the hot weather was over, part of the blocks didn't fill up but they continued to move.

Mr. Buehler: I recall that particular street, in fact I made a special investigation of it. For some reason or other soon after



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Mr. Buehler: I recall that particular street, in fact I made a special investigation of it. For some reason or other soon after the blocks were laid they began to shrink. The blocks were laid on a bituminous cushion and I understand that there was a considerable period of time between the laying of the blocks and the filling of the joints. During this time the blocks shrunk to the extent that the joints were quite wide. When the filler was applied the joints were completely filled. The blocks continued to shrink even after the filler had been applied, and as a result the joints opened up and the filler flowed to the bottom of the joints. The shrinkage of the blocks was very great, in fact there were a number of cases where the joints between the blocks were in excess of one-half inch. An attempt was made by a second application of filler to completely fill the joints that appeared to be empty, due to the shrinkage that I have referred to. This second application of filler resulted in a considerable excess of pitch on the surface of the street and also bitumen resulting in an excess of filler in the joints and under the blocks, which flowed during the hot weather to the guttes, altogether producing a very unsatisfactory condition. Mr. Horner, City Engineer of St. Louis, has been making a very thorough investigation hoping to determine the exact reasons for the failure. There seems to be something peculiar in the excessive shrinking of the blocks which we hope to have cleared up by Mr. Horner's investigation.

Member: I would like to ask Mr. Buehler if he ever used a sand bituminous mixture instead of an ordinary sand mixture?

Mr. Buehler: Such a mixture has been advocated, but with the exception of one or two cases in connection with interior floor construction, I do not know of its use.

Question: What do you advocate in the way of laying the blocks? I notice on some streets they are laid at long angles with the curb and at other places they are laid at right angles. Is there any preference?

Mr. Buehler: We used to have a theory that you could better take care of expansion by laying the blocks at an angle, but there really wasn't anything to it. There is good reason, however, and that is in carrying the traffic. If the blocks are laid on an angle under horse-drawn traffic there is less tendency of wear on the joints. It is particularly noticeable at intersections, but that would be the only reason for laying the blocks on an angle. I believe the general practice is to lay them at right angles.

Mr. De Berard: A clipping came over to my desk this summer to the effect that some city—I have forgotten the name of it now, I am sorry—was having difficulty in getting money to buy pitch to put on the surface of their wood block pavements. It had been the practice, apparently, every summer to apply a certain amount on top of the blocks in the summer or late in the fall, with the expectation of sealing the tops to keep the water out. Is that done to any great extent?

Mr. Buehler: I have never heard of a case where they have used pitch for that purpose. I rather imagine pitch would make a nasty mess on top of the pavement, but it has been the practice in a number of cities to use a light refined tar, a tar that can be applied cold. In the summer, when the block is dry, it is thoroughly cleaned and then a light application of about a quarter of a gallon to the square yard is applied and allowed to remain about twenty-four hours, and then a second application of about a quarter of a gallon is applied, and these two applications are then covered with sharp sand. In Milwaukee they have one or two streets surface treated in that way. In the city of Memphis practically all of their wood block streets have been surface treated. It is a good way to take care of old wood block streets that are causing trouble due to excessive expansion. I certainly would not want to recommend pitch for that purpose.

Mr. Tillson: I was very much interested in Mr. Buehler's statement; perhaps more critically than some others because a good many of the specifications that he criticized I probably had as much to do with formulating as anyone else. Of course we expect, in the development of any industry, especially a young industry, as the block paving industry is, to make great improvements, and I agree with a good many things that Mr. Buehler says. It may be somewhat interesting to review the reasons why those early specifications were made as they were.

Now when a wood block was first proposed—the first pavement was laid in Boston in 1900 I think—and then two years later a sample street was laid in Brooklyn, New York. In 1903 the authorities wished to lay more of the wood blocks, and it became necessary then to have specifications. We could not make a specification just as we wanted perhaps, because under the law in New York City we could not receive any bids for a patented article in pavements. Some of the representatives of the company and myself got together to formulate the specifications. I knew what the city wanted. They knew what the companies could produce. The result was that those specifications were made, so that the wood must be treated with twenty pounds of mixture, composed of one-half of creosote oil, one-half of resin, or some other material that enabled us to get the specifications by the Corporation Counsel. The specifications also provide that the blocks should not absorb more than three per cent of water when dried at a temperature of about one hundred degrees, for twenty-four hours. Now I felt satisfied that we would get what would be practically a non-absorbent block if those specifications were complied with, and the representatives of the company said they could comply with them. We took in the bids and the lowest bidder was this company, and their blocks did comply with those specifications. In one other block where another party was the lowest bidder we took in the specifications and laid the pavement, with practically the same result except that the first lot of blocks that were submitted—in fact there were a few that stood up on all the requirements of the specifications, that the shipment was rejected. The contractor came and said he couldn't use those blocks, but if we would test them so he could use what would fill the specifications, he would pay for the extra inspection. We had made tests enough to satisfy ourselves that the blocks that would sink in water could comply with our specifications, so we put an inspector on the job and handled it in that manner, and the pavement gave perfect satisfaction.

Ten years after one of the streets had been laid I took the city engineer of Indianapolis over the street. We got out and examined it. He said, "Where are your expansion joints?" I said, "There are none." He took out his knife and he spent I guess four or five minutes in going over that pavement, lengthwise and along the curb, to see if he could find expansion, and gave it up and said, "I guess you're right." Now I think the whole secret of those blocks not expanding was because they were so treated they would not absorb water enough, but in a short time the resin proposition became so expensive that it was thought desirable, if possible, to get something else, and the theory of the process was that the creosote would preserve the block, that the resin would keep the creosote in there so that it would not evaporate. We thought if we got a heavier oil it might act in the same way, and that was the reason why the engineers in the East and other places came into the paving specification organization which Mr. Buehler referred to. We stuck to heavy oil because we felt that it would resist the action of the atmosphere and would not evaporate. We felt that if the wood was preserved, especially on residence streets, it would give a wonderful life.

One concrete example I can give of that is one block of a street in Brooklyn, after it had been laid down ten years. Part of it was on exhibition at various places. They took out a square about that large (indicates), I guess, and it showed a quarter of an inch wear after eleven years. Now, assuming a block will do that, and the creosoting process will preserve it, you would have a life of forty-four years for that pavement.

I know that a good many streets that were paved with wood in Brooklyn, as far as wear is concerned, would last one hundred years providing that the treating process was such as to prevent decay.

Mr. Buehler said that the early specifications provided for a sand foundation. That might have been so in the West. It was not so in the East. In the first specifications that were made we felt that we must of course get a solid bearing, a good firm footing for the blocks themselves, and we used the mortar bed, the sand and the cement, and it was always very satisfactory. It has not been the custom in the East to use sand cushions, although it has been used in some cases, but never generally.

In the beginning of his talk Mr. Buehler asked questions that I think might possibly be answered. One was, "Why creosoted wood blocks?" and the other, "Why the use of wood blocks?" The first question has been partially answered by me; in order to make the blocks last as long as they will without decaying and until they wear out. In Europe it has not been the custom to treat blocks to preserve them from decay because they generally wear out before they rot out. An engineer in London has made some observation concerning the traffic conditions over there, sufficient to determine just how much traffic will wear out the wood pavement, and from that he has deduced a formula so that by observing the traffic on any street he figures that he can determine just how long a wood block pavement will last on a street, because it is the wear rather than the decay.

As to the decline in the use of the wood block—I am speaking especially of the East, where I am most familiar with conditions. During the last ten years there has been a great advance in the construction of pavements. They are very much improved. When the wood block pavement was first introduced in the East it became popular at once because it was smooth and almost noiseless. It was exceedingly desirable in front of schoolhouses, hospitals and churches. Since that time, besides this change from the granite pavement there has been a great change in the method of travel. There is a small amount of traffic in New York City on steel tires at the present time, where there used to be hundreds and thousands of those heavy trucks with steel tires, making an enormous noise on the streets. Now you have the rubber tires, and the noise is very much less, especially with the improved form of the pavement. You will find that the stone block in many cases is not at all desirable on account of noise—that is with the steel tire trucks.

Some mention has been made about strips between the blocks. I saw one or two very exaggerated cases of that in London. They use strips there. The blocks themselves are only about three inches wide. There was a strip about seven-eights of an inch wide and the street extended from a half to three-quarters of an inch above the blocks. They are laid on a grade of four or five per cent. It was not used to any great extent, but it was used in the cities west of London.

Another interesting point to me was the slippery condition. It was in Berlin and Vienna, where they use asphalt to a great extent, particularly in Berlin on the approaches to bridges, where the grade would be a little steeper, they use wood blocks because it was not slippery, and they had exactly the reverse of what our experience is in this country. In Berlin, however—I am speaking of pre-war conditions—the streets were absolutely clean, so there was not that slimy condition which Mr. Buehler described exists in the loop district on the wood block. I think we will accept the fact that if we have a wood block pavement we must have a pavement which is more or less slippery, and it must be taken care of in some way or other, and I think the creosoted block is more slippery than one which is not creosoted. That is all, I think. (Applause.)

Mr. Buehler: I do not care to prolong the discussion unnecessarily, but I want to again call attention to the fact that traffic conditions on the streets of New York are entirely different than the traffic conditions that obtain in most of our cities in the central west. The conditions are different in laying a street in Grand Forks, North Dakota, as compared with New York. The construction that would give perfect satisfaction in New York might not fit the Grand Forks situation at all. In other words, if you eliminate the traffic, the ironing out effect and the waterproofing effect that the traffic has on the top of the block, considerable more care must be taken in the treatment of the block and in the construction of the pavement.

Mr. White: As a matter of history, I will speak of one or two things that come into my mind in connection with block paving in Chicago.

I think the oldest piece of wood block paving was laid on Michigan Avenue in front of the Congress Hotel. I am not positive as to dates, but I think it was 1901. Can you verify that, Mr. Buehler?

Mr. Buehler: I think it was 1900.

Mr. White: That remained in service until 1912, when the street was widened. It never gave any trouble as to expansion, although there were expansion joints at the curb, which had been obliterated by the expansion of the blocks. It was an experimental piece of pavement and was not laid under any recorded specifications that I knew of. I had nothing to do with the laying of the pavement and only knew it afterward, but in about 1905 we endeavored to extend that pavement to complete the block between Van Buren and Congress. I meant to say that this first block pavement was laid on a cement mortar base; a wet mortar which was rolled and spread immediately in front of the block layers. We tried to repeat that experiment or repeat that process in 1905 in completing the block. That piece of pavement, however, was not at all a brilliant success. There was a great deal of expansion which should not be charged against the character of the foundation, of course, but it was not altogether successful. I mention these cases rather as a matter of history than anything else; not for any lesson we may be able to draw from them. I think it establishes the fact that our earliest pavement—that is block pavement—was laid on a mortar base. Afterwards, in working on it, the park commissioners, who had control of the work, the blocks were laid on dry, mixed cement base on account of the exceeding difficulty in spreading and laying the blocks on a soft or fresh mortar base.

Another thing I just wish to speak of, and of which Mr. Tillson reminded me—I remember seeing a number of years ago in Boston one of the rather steep hillside streets, where a block pavement had been laid with using common lath strips between the rows of blocks which were afterwards removed, and the wide joints thus left were filled with cement gravel. I never knew what the final result of that was, but the effort there was to produce a pavement that was not slippery. Did you ever hear of that, Mr. Buehler?

Mr. Buehler: No, I have not.

Mr. White: I had the opportunity of examining it shortly after it was laid, but did not follow it up.

Mr. Dailey: Mr. Buehler spoke of the pavement on the west side of Dearborn Street in front of the Federal Building. The city laid that pavement in November, 1914, and it was largely an experiment, as I believe it was the first time in this city that wood block was laid without using a sand or mortar cushion. On the south portion, from Jackson Boulevard to Quincy Street, the blocks were laid on a bituminous cushion not more than one-eighth inch in thickness, which was applied hot, by means of a squeegee, immediately ahead of the paver. On the north portion, between Quincy Street and Adams Street, the blocks were laid directly on the smooth concrete base without any cushion at all. There was an expansion joint put in along the curb, and it was interesting to note that this joint disappeared within about a month, where there was no cushion under the blocks; while on the portion where the bituminous cushion was applied, this joint did not noticeably disappear until the next summer. It appears, therefore, that the blocks that were laid directly on the smooth concrete were shoved toward the curb by the traffic, while those laid on the bituminous cushion practically held their place until expansion set in.

This method of laying wood block, namely, on a bituminous cushion applied to a relatively smooth concrete base, is no doubt a decided improvement over the sand cushion, or sand-mortar cushion method, and, as Mr. Buehler said, it is cheaper. Very little extra cost is induced by finishing the concrete surface sufficiently smooth to receive the blocks, and the saving in sand and cement more than offsets the cost of the bituminous coating. The cost of the Dearborn Street job, as I remember, ran a little high, but, as I said, it was more or less an experiment, and we took particular pains to finish the concrete smooth. It was a new method of construction at that time, and any new departure from the usual method, with a gang of laborers accustomed to doing work a certain way, will result in an increased cost.

In connection with creosote block paving, there are several points I would like to ask. I understood you (Mr. Buehler) to say two of the main objections are the bleeding and the expansion.

I believe the city officials in the Bureau of Streets, where I am employed, receive more complaints about the slipperiness of the blocks, particularly those in the loop district, than from any other source. I know attempts have been made to treat the surface of the blocks after they have been laid for some time, to relieve this condition, and I would like to know something of your experience on this point.

Then, again, there is the method of laying the blocks with a "spacer" between each row to give horses a foothold. A year ago the city laid a small stretch of wood pavement in Twelfth Street just east of Wabash Avenue, on the approach to the viaduct. We put a creosoted strip of wood, one-half inch in thickness and 3 inches in depth, between each row of block, and filled the remaining space with a mastic of fine gravel and bituminous filler. This method of laying practically eliminates the slipperiness, but this pavement has not been down long enough to test the durability of the blocks, and perhaps Mr. Buehler can enlighten us on the success of this type of construction in other cities.

I have one other point in mind. In this discussion I noticed you used the word "bituminous" in speaking of the cushion and filler. That word covers a very wide field, but in Chicago our experience has been confined mostly to the use of pitch and asphalt, with the preference in favor of pitch. I would like to know if that is not the general tendency among engineers in the laying of wood block pavements.

In conclusion I want to say I was very much interested in Mr. Buehler's paper. I know he has made an exhaustive study of this subject and can speak with authority. The points I have raised are matters of frequent discussion, and I feel that Mr. Buehler can further enlighten us.

Mr. Buehler: Mr. Dailey's statement relative to Dearborn Street pavement was very interesting, and in my opinion a very valuable lesson may be learned from a study of it.

In reference to my statement relative to the main objection to a creosoted block pavement, the point I tried to bring out was that the improvement in the methods of treatment and construction were the result of trying to eliminate the two main objections, expansion and bleeding. Any pavement covered with a fine film of dirt when wet is slippery. A reasonably clean wood block street will not be any more slippery than any other type of pavement. In the city of Minneapolis it has been the practice to cover the completed pavement with sand and then by a thorough sprinkling maintain a moist condition, which prevents the sand from blowing and permits the traffic to grind the sharp particles of sand into the surface of the block, thus producing a non-slippery surface. Of course, it is very apparent that sprinkling is essential, otherwise any sand covering would soon dry out and blow away.

In reference to laying blocks with a spacer such as referred to by Mr. Dailey is practiced on Twelfth Street in this city, I wish to say that personally my preference would be a "LUG" block, that is, a block manufactured with small separating lugs on sides and ends. Such a block will permit of sufficient separation to provide for a foothold for horses, and can be more readily handled and more cheaply laid than the rectangular block with strips of wood. Then in my opinion there is an objection to the strip of wood in that it sometimes prevents the filler from properly painting the sides of the blocks as it is difficult to pour the filler between the side of the blocks and the spacer.

In reference to the use of the word "bituminous" and the preference between pitch and asphalt, of course, being the representative of the Barrett Company I might say that I am entirely disinterested, but frankly I have purposely refrained from mentioning the word "pitch." Now that Mr. Dailey has brought up the question, I wish to say that for a great many purposes asphalt is very good. In connection with the wood block pavement, however, it has no place. The object, as I explained, of a filler is to seal the blocks. Asphalt will not adhere properly to a creosoted block and therefore will not waterproof it.

City Zoning in Chicago

By Mr. Charles H. Hammond,
Illinois Society of Architects.

I FEEL that one of the most important things that I gained in the trip that we took through Canada and the East was the fact that there should be no compromise whatsoever in the way that Chicago tackles this problem, that we should stand for nothing short of a comprehensive plan with a regional survey that will cover the metropolitan district of Chicago from Gary to the Great Lakes. We want to plan Chicago for a city of at least ten million inhabitants. Chicago is destined to be the greatest city in the United States, possibly not in our lifetime, but our children will probably see Chicago a city of ten million inhabitants.

In most cities where they have good building laws they find the worst conditions exist in the outskirts, or the district surrounding the city, where the laws that regulate the cities do not apply. In this regard I will say Illinois will undoubtedly have a zoning law that will cover the State, so that those districts should be wiped out, when we have a proper zoning law, covering not only the city, but the State as well. Chicago will undoubtedly study this problem in a way that none of the other cities have done, because we ought to benefit by what New York and other cities have found to be advantageous. In one way I am certain that we will do something that the other cities have not done. I have already taken it upon myself to talk to the government officials to see if we can't start right with a photograph of the entire district from the Great Lakes to Gary, a large mosaic photograph made up of pictures taken from airplanes that will be put together, giving us a photograph of the entire metropolitan district, so that we may see what the conditions are today, and not have to study from maps that were drawn years ago, in our effort to find out what conditions exist in our city today. The government officials said they didn't see why we shouldn't secure such a photograph, and the only thing the city would have to do would be to pay for the gasoline to run the ships.

We saw a great many things that impressed all of the men on this trip. I repeat, that Chicago should tackle this thing in a big, comprehensive way; this is one thing that I believe we should all fight for. We should not allow a piece-meal program to be followed, because if we do we are going to have legal difficulties that will probably set us back years, because of the adverse court decisions that might be made; for if a district is zoned they may treat a section in that district similar to a section in some other part of the city in a different manner, and when regulations are applied to the latter district, if the same regulations do not apply that did in the former case, the city will have a legal fight that will operate to put the entire law in the discard.

Nearly everyone that attacks the problem lays great emphasis upon the importance of the zoning of Chicago in order to protect the home owner, especially the small owner—and too much cannot be said in this regard—as the benefits to this class of property owners, through a properly created and administered comprehensive zoning plan are too great to be estimated; but what about the industries? Many men interested in industry believe that zoning is a one-sided proposition, and that the residential districts will secure all the benefits to the detriment and hampering of proper industrial development.

We saw many instances in St. Louis of where St. Louis is jumping to the fore through the proper regulation of their industries and the creation of new industrial districts. In one section we saw an entirely new district where they are spending thirty million dollars in building new plants for the General Motors Corporation and the United Drug Corporation. We must all realize that zoning has to do with the exercise of foresight, common sense and business judgment in regard to all questions relating to civic growth and civil welfare.

Under a wise system the first question to be considered in the planning or zoning of our city is the question of its industry, as such a word may be used to represent the whole of its productive industrial and commercial undertakings, a matter of some four billions of dollars representing the yearly production.

The life of our city depends upon the units of its industrial organization which provide the necessities of life, food, clothing and shelter, and we can exist only so long as we have the means of securing these necessities.

The problem before Chicago is to secure these necessities through the proper relation and inter-relation of all phases of our complex city life withoht impairing the health and convenience of our people.

The main factors in promoting industry, we have learned through the experience of the last few years of war work, are the factors of the nerve-power, capacity of concentration, the physical endurance of the workman. These are facts becoming more and more important. The manufacturer has come to know that skill does not count for everything, a man has to have that power of nerve and endurance which will enable him to concentrate on his work from morning to night, in order to be an efficient instrument of labor.

These are the things that we need most to conserve and the very things we are destroying by bad housing conditions.

The proper regulation and building up of districts for the housing of industries' labor supply will not only benefit the industry, but the entire community as well. Business districts are changing, residential districts are being transformed into manufacturing districts, and it will be the duty of those in charge of our zoning to direct changes, and also tendencies to change, in old centers, so as to improve conditions for the worker, and also so that the best facilities will be provided for transportation and expansion.

Proper zoning will regulate our civic growth by wise city planning through the co-ordination and co-relation of all the facts and elements of our city growth, so as to promote industry, health, convenience and beauty, so as to secure industrial success without impairment of health, health without injury to industry or just rights in property, convenience and beauty without extravagance, and remodel old conditions, as well as to prepare plans to deal with new conditions, keeping always in mind the fact that the industries must not be hampered, but must have room for adequate expansion, good and efficient labor, cheap power and convenient means of transportation. I thank you. (Applause.)

February 5, 1920

City Zoning in Chicago — *Continued*

By Alderman Albert J. Fisher,
Chicago City Council.

I SUPPOSE I am what might be called an added starter, for the reason that I am Chairman of the Local Industries Committee, which has to consider all industrial ordinances. We had between four and five hundred of those ordinances last year, which were more than a majority of all the city council ordinances. Our committee went on this trip of zoning inspection, taking in the Northwest, the Middle West and the Southern manufacturing cities. We did so on the urgency of a number of public bodies who thought zoning ought to be approached from the industrial angle. I am compelled to agree with them for many reasons. I don't know whether you gentlemen know it or not, but Chicago is shrinking, shrinking materially, and has been for many years, in her manufactured production. We have the greatest freight carrying terminal facilities in the world here in Chicago; we have over forty freight carrying roads, and we ought to have an output of manufactured products commensurate with the ability of our freight carrying roads to take care of that product. We have been slipping back. We are not offering to industries what we ought to offer in a city like Chicago. We are not making the load easy for them to carry by locating in Chicago. We ought to have today all the automobile industry in Chicago instead of it being in Detroit, unless you might exempt the Ford and Cadillac plants, which, of course, are indigenous to Detroit. The factory men come here and investigate our facilities and they turn their backs on us and go to more progressive cities and erect their great manufacturing plants. Kansas City comes here and advertises in our own papers that she has beaten us on manufacturing propositions. St. Louis is doing the same thing. New Orleans passed the hat and took up a one hundred thousand dollar contribution, donated by her public spirited citizens, for the purpose of advertising in every great journal of the United States New Orleans as a great manufacturing center. They are getting some tremendously big plants there, and we are offering very little inducement for them to come here instead of to New Orleans. Here is what an industry must have. It must have a location along a freight carrying road where it can put its product right into the train and have it go to any point in the globe with dispatch, and where that plant will not have to be located so they will have to truck all that stuff through the already congested streets of Chicago and add to their cost of operation to such an extent that they would find it profitable to go elsewhere and establish themselves, and where they would not meet such unfavorable conditions. God Almighty has zoned some of these cities topographically by nature. In St. Louis Mill Creek Valley with its railroads comes right down through the center of their city. All the industries are located on those roads, on one side or the other. They are right now developing two big industrial propositions, one on the north and one on the southwest side of St. Louis, and throwing in a belt road to take care of them. It is the same thing in Birmingham. All the factories are right there together, except the steel plant, which is located outside. The result is that what they have adopted in factory location facilities, you have got to adopt in Chicago, that you may put your factories along the freight carrying roads. Today the center of Birmingham, where all the railroads are and the industries are, is given up residentially to the black population.

New Orleans is today putting in a canal six miles in length from Lake Pontchartrain down to Mississippi Sound, with rail connections on both sides, and is advertising for factories, and she is getting some enormous plants in there before a spade has been put into the ground towards the completion of this project. She has floated a bond issue of eleven million dollars to build that canal. If you are going to zone Chicago for the benefit of the future Chicago, you must take care of what we have been losing right and left for a number of years—that is, our manufacturing and commercial life. It doesn't make any difference what kind of a home a man has, if he has no place where he can work and earn a living for his family. It makes no difference how fine his home is, he can't live there under such conditions, and that is all there is to it. I want to tell you gentlemen, every city we visited—and we visited twelve—has brought it more clearly to my mind than anything else, that the first thing you have to provide for in a zoning proposition (and it must be a comprehensive one) is to see that your industrial future of Chicago is preserved, protected and guaranteed for all time, so manufacturers may know that they can come to Chicago and locate here, and will receive all advantages which will enable them to conduct a business here in a profitable way. We have that to offer them if we can take care of it under the zone system.

The commercial end of it has been dwelt on very largely tonight. Lindell Boulevard, which was the pride of St. Louis, has been encroached upon commercially to such an extent that today they can't put that thoroughfare into the No. 1 residential territory at all. They have had to put it into No. 2 class; and they are now trying to preserve a little short street called the "Kings Highway" from similar encroachment. The residential, the commercial, the industrial—they are all absolutely essential, and they call for equal attention and equal provision. The future of Chicago is going to depend a great deal on what now is going to be done.

I want to read to you the report that my committee, after visiting twelve of the manufacturing cities of the Middle West and South, introduced in the last meeting of the City Council. An attempt was made to dissuade us from putting this report in, but we stated frankly that from what we had seen and learned we could not put in any other kind of a report.

Nov. 24, 1919.

To the Honorable Mayor and City Council of Chicago in Council Assembled:

Your Committee on Local Industries, having had under consideration the facts revealed by its extended investigation of industrial zoning throughout the principal Middle West and Southern cities, and of the relative results obtained from the various methods of industrial, residential and commercial zoning, as already adopted or under present consideration in many of those cities; and having noted unmistakably the harmonious working and uniformly beneficial results to all interests involved in such cities as are operating under a comprehensive zoning system, as for example St. Louis, Birmingham, and now to be adopted in Omaha and Milwaukee, in contrast with the serious and constantly recurring conflicts of interests and consequent mandamus and injunction proceedings instituted in such cities as have endeavored to operate under a piecemeal method of zoning, of which Minneapolis is a conspicuous example, desires to report to your honorable body its findings and recommendations.

Recognizing that wherever a piecemeal method of zoning has been adopted it has miserably failed, only to be followed by the adoption of comprehensive methods, your committee urges the immediate securement, at the earliest possible moment, of the passage of an enabling act in the General Assembly of Illinois, which will permit Chicago to adopt and act under a city-wide comprehensive zoning ordinance; and this committee further recommends, taking advantage of the mistakes of some other cities, that no action be taken by the City Council of Chicago in the way of re-zoning Chicago in piecemeal fashion, which is the only manner possible under the present existing laws, and that no action be taken disturbing present conditions of property uses and values until such time as the necessary enabling comprehensive zoning legislation shall have been secured.

In order that there may be no unnecessary delay in the practical zoning of Chicago at the earliest possible moment, and for the securement of the various, most practical results, your committee also desires to submit that in its judgment, as was done in St. Louis, Birmingham and other cities, where the best working results have been obtained, the Chicago Plan Commission should be the body to whom should be entrusted the comprehensive zoning of this city; and that to its architect and consultant, Mr. Edward H. Bennett, who in laying out the Plan of Chicago has done a greater work than has ever been done in any other American city, should be entrusted the detail planning of such a comprehensive zoning system.

The reasons for these recommendations will be obvious when it is borne in mind that His Honor, the Mayor of this city, is the President of the Chicago Plan Commission; that one Alderman from every ward is likewise a member of that commission and therefore in touch with and a direct participant in all its work; and finally, that by placing the proposed comprehensive zoning under the direction of this commission and its technical men, great probable confusion will be avoided and serious conflict in many directions forestalled in any zoning plan which otherwise may be proposed when not properly correlated with the City Plan of Chicago, which the City Plan Commission and the public have adopted for the carrying out of which the public has recently voted bond issues to the amount of $28,000,000.

Should it be decided that, as in St. Louis and other cities, to the Chicago Plan Commission should be entrusted this work, it is herein suggested that to avoid any unnecessary delay in the work, pending the necessary legislation, said commission be requested to at once employ its technical staff in a preliminary comprehensive survey and the drafting of practical details.

Respectfully submitted,

ALBERT J. FISHER, Chairman.

Minneapolis has quit, thrown up her hands; she is going to abandon the piecemeal stuff altogether and start entirely new. Milwaukee the same. Omaha was considering the piecemeal plan, but she has quit and is going to adopt a comprehensive plan.

I want to tell you gentlemen everybody in Chicago today is scared to death. They are anxious for the reason they don't know what is going to happen. They think a little territory is to be picked out here and there, and that you are going to pass discriminating legislation in regard to that strip, while another little strip over here is going to be picked out and perhaps another treatment meted out to that, until all the manufacturing interests and the owners of property in this city are simply on the qui vive today, wondering what is going to happen to them individually. If it can be settled that this zoning is to be done under a comprehensive plan that will include all territories of the city of Chicago, laid out uniformly for the protection of every interest, and the protection of every interest against every other interest which would conflict, the result will demonstrate that it ought to have been done twenty-five years ago.

Now, gentlemen, this matter of having the Technical Board of the Chicago Plan Commission do the work is only suggestive. It doesn't agree with what Mr. Ackley has told you, but it is based on what we saw. The City Plan Commission of St. Louis laid out St. Louis; that is, the Technical Board of the City Plan Commission. The consulting engineer of the City Plan Commission, Mr. Bartholomew, supervised the work. The Civic Commission of Birmingham laid out Birmingham. The same is true of New Orleans. In such cities as have no City Plan Commissions they are borrowing now the engineers of the City Plan Commissions of St. Louis, New York and other cities. In Omaha, Milwaukee and other places, this is what has been done and it has worked successfully. It is obviating mistakes that otherwise, in my judgment, would have been innumerable in those cities.

I want to say, gentlemen, that this recommendation was not even with the knowledge of Mr. Wacker, Chairman of the Chicago Plan Commission, or of any member of that commission. Bear in mind that the law as we now have it, or the law as it will be passed, will empower the City Council to adopt a method for zoning Chicago.

Of course, gentlemen, it is understood that if the Chicago City Plan Commission were to accept and undertake this work, it would only be in conference with all the other interests involved. They wouldn't attempt to cut out something here without considering and consulting with all the interests. Neither would their architects and their consulting engineers undertake to do this without bringing in the advice of such men as Mr. Bartholomew, Mr. Swan, Dr. Whitten and others. There is a possibility of men from another territory coming in to lay out detailed plans for our comprehensive zoning in Chicago, which would impinge and cross wires in a thousand ways with the City Plan of Chicago; and after the taxpayers have already invested millions of dollars in Michigan Boulevard, in accordance with that City Plan, and are now going to invest twenty-eight million dollars more in improvements to carry out that already adopted Chicago Plan, I want to tell you one of the things—one of the first things—we want to conserve is to see that the plan is not impinged on and ruined by people who know nothing and care nothing about the City Plan of Chicago.

In my mind here is the crux of this whole proposition so far as industrial zoning is concerned. You have a network of tracks all over Chicago. You have nothing like it in any other city where zoning has been talked of. You have a problem of your own with which no city in the United States compares. When you adopt a fundamental principle (which every city has adopted or at least has in actual operation) that the highest use to which you can put property contiguous to freight carrying roads is industrial, you have protected your residential districts and gone a long way toward zoning Chicago residentially. You have also doubled the value of every foot of ground in that industrial zone. You have made it square foot property instead of front foot property. If a man had a small home there it has doubled the value of his property for industrial purposes, and you have protected the congestion of the streets of Chicago from factories which otherwise would have to truck everything through the streets of this city.

City Zoning in Chicago—*Continued*

By Mr. D. L. Goodwillie,
Union League Club.

Mr. Chairman and Members of the Western Society of Engineers: When the Union League Club asked me to represent them on this trip, let me say to you gentlemen it wasn't a junket by any means; there was lots of hard work; I have never known business men to put any harder licks into a job than did this entire committee from the City Council. When our club asked me to go they gave me about an hour's notice and told me to pack my grip and go. While I had plenty to do in my business, though knowing nothing about zoning, I was persuaded to take the train that evening and to join the forty or fifty gentlemen and proceed with them. I will say frankly that I went into zoning on this trip rather prejudiced against zoning. We had had two or three experiences in the handling of our land up on the North Side that made me feel that way about the proposition. I had an idea that it was largely an industrial proposition, and I had an idea it was a scheme whereby while if you were to lay out a new town you could apply it intelligently, that it couldn't be applied intelligently to a city already built. You will see, therefore, what obstacles I was working against.

We went to Toronto. We did several cities. I had hardly gotten to New York, after seeing Toronto and Ottawa before I made up my mind that zoning was a thing that Chicago could use and should have. There was no question about it, and the quicker we got at it the better. I quickly came to this conclusion. As long as we have half a dozen speakers I shall not take ten minutes, but I want to just speak along two lines. I came to this conclusion, that with zoning the small householder need not fear the value of his property, nor its depreciation. That zoning, properly applied, would standardize it and stabilize it and give it a monetary value that it had never had before. I believe that thoroughly, gentlemen. That is the message that we want to take, and that I hope in our coming conference we will take to the fellow on the outside, the small householder—the voter—that he need not fear the man down in the Loop, but that zoning will help the man living on the outside. The small householder comes along and he has his property, and *if* he is under a zoning system he is assured that within certain lines he is taken care of, and he can go ahead and make his permanent improvements; he can build his little garage, he can raise his one-story cottage to a two-story dwelling, and yet he has his home, and it is his castle. Without zoning that privilege is liable to be very soon, or sooner or later taken away from him. We can't help it in the hit and miss way in which we do business now. Right across from the man with the little home is the big industry that he works for. Usually the industry wipes out the home. The employe is just as essential to one as an employer every day in our work as I am to my institution. Therefore, in the best interests of the whole city, zoning will help just along that line in caring for the industry and protect it from being overrun by homes or by institutions that don't belong in that section.

Then I want to take up the other side of the proposition, and that was the one that appealed to me as much as any. In talking to one or two members of our School Board, I found from the Vice-President of the School Board that in figuring on the rooms in the school they called a room without the bath and without the power equipment worth about $20,000 per room, and that very frequently, very frequently they would hardly get the school built in a neighborhood where before they would start it would be taxed to its utmost capacity; but very often before that school was finished the people would be driven out and the use for that school would become void.

Zoning would help the situation there to this extent. The School Board would not have to go ahead and buy property and gamble on it. They would buy the land as they need it and condemn it as they wanted it. The School Board would take that building and erect it for all time, knowing as they do now that no child should have to walk over half a mile to get to his school, that in a year or ten years from now in a residence locality that school house and room would be available and it would not be doing business on a fifty per cent basis, with a big overhead, as it is now. We found on that trip that some of our schools were absolutely not in use, and they had no way, very frequently, of disposing of them. It does not take very many of us lumbermen or merchants or even you engineers here long to see how much zoning would help that very situation.

I am particularly interested in zoning because I believe that with this new era of doing things the selfish side of living, the selfish side of business, would fast change and cease. I read in the *Tribune* here a little while ago an item by Capper & Capper, written by Mr. John Capper. It reads like this: "The day of greed and selfishness is past. The time has come when we are dependent one on the other. The time has come when a man must give up a great deal that the majority may be benefitted," and while zoning may hurt, and it may seriously cripple an individual here and there, we have got to be big enough to sense the situation and swallow it if by hurting one individual we are benefitting the big mass. I really believe, in the long run, it will be a very occasional case where zoning will hurt the individual. I believe in the main it will help. I believe for Chicago we can't get at the job too quickly. I believe that beginning with the outskirts we should spread this gospel to the householder, for the householder is the man who makes our city. He is the man that makes the good citizen. I believe that we should let him know that *he is being taken care of,* and zoning will absolutely, I believe, if properly carried on, not in any piecemeal fashion, but through a big scheme, will take care of that man. I thank you, Mr. Chairman. (Applause.)

City Zoning in Chicago—*Continued*

By Mr. Ivan O. Ackley,
President Chicago Real Estate Board.

WHEN Mr. Artingstall asked me to come here and speak tonight I told him that I had been facing the President and the business agents and the walking delegates of the janitors' union for the past three or four weeks and that I didn't suppose that this operation would be much worse than I had gone through heretofore. (Laughter.) Now I feel that it is a decided compliment to be invited to speak before a highbrow organization like this, because a real estate man is usually celebrated for his breadth of vision but not for his depth of thought, and therefore I think that the Western Society of Engineers ought to be complimented because they are now taking on speakers who are more or less gifted in breadth of vision, and leaving out so much profundity of thought, which I understand is the commodity engineers usually deal in. Zoning—we have heard so much about it and so many different phases of it that I will start out perhaps at a little different angle than I had intended. I am sorry that I was so far down on the program, because these real estate men, you never can depend on them, if you tell them anything about your speech before the meeting they will steal your thunder every time, and that is what they have done tonight.

Zoning, unlike most of our municipal problems, is a comparatively new study. In Europe zoning has been in successful operation for probably thirty-five years or more, but that is due largely to the fact of their arbitrary method of enforcing law. In America, under our liberal democratic institutions, it is not possible to enforce a new idea like this the same as they can in Europe. In Europe, for instance, all that is necessary is to convince those in authority. In America, in order to put a new idea over, we must, of course, convince the masses and the voters, and have their support before something like zoning, which affects practically all of the visible property in our cities, can be made effective.

In Chicago zoning has been seriously considered for perhaps ten or twelve years. This is true practically everywhere in America. Now we have here what is known as the Chicago Plan Commission, which is a splendid institution, and I have been asked a number of times why the Chicago Plan Commission could not take up the work of city zoning. The reason is that the Plan Commission deals exclusively with public properties, such as parks and playgrounds, and depots and harbors and waterways, and all public institutions. Zoning, on the other hand, deals exclusively, and must deal exclusively, with private property, and when you consider that the Zoning Commission that we will eventually have here in Chicago will deal with something over three billions of dollars worth of property, you can see what a gigantic task this Zoning Commission will have to perform.

About 1911 the Chicago Real Estate Board first took up the study of zoning. We pursued the study by conferences with various city officials and with our own members for about five or six years. In 1916 a bill was prepared which was introduced into the state legislature. This bill was defeated because we had no support in Springfield. We learned a good deal about the wiles and ways of politicians, and we came back much wiser than we had gone down there. But we had succeeded in making a very important convert to zoning in the person of Senator Glackin. Mr. Glackin took a deep interest in this subject, so that this last year, when we again wished to secure a bill from the legislature we decided not to take the proposition up ourselves, but to secure the assistance of some man whom we could depend on, and we went to Mr. Glackin, and through his assitance we secured the present zoning bill, which was changed several times after its introduction in the legislature, but which was eventually passed and is now on the statute books.

This bill gives additional powers to the City Council, powers which the City Council did not possess heretofore, powers that were necessary before a zoning ordinance could be put into effect in Chicago. The first act that must be performed under this new law is the appointment of a Zoning Commission. This Zoning Commission shall be appointed as provided in the bill, by the City Council and the Mayor. It is general in its terms. It does not state how many shall be on the commission or who they shall be or what compensation, if any, they shall receive. We men who have been studying and making recommendations in regard to this commission feel that it should be a non-partisan, non-political, purely independent commission, the same, for instance, as the Chicago Plan Commission. They had that sort of a commission in New York. The men served for two years, constantly, sometimes days and nights, without compensation, and they have furnished New York with the best zoning ordinance and the best zoning system in effect in this land anywhere, and I am confident that if this commission in Chicago is appointed in the same manner, that we can have just as effective and just as efficient a commission in Chicago, if we are given the opportunity. I think the members who constitute the commission should be men who can bring something to it. For instance, there ought to be, to begin with, engineers on the commission, because they can bring a good deal to the commission in the shape of technical knowledge. There ought to be real estate men—I should have mentioned that first. (Laughter.) There ought to be lawyers and a great many other technical and necessary men that can be of inestimable value to the commission.

The way the bill is drafted now, and I think there are some mistakes in it which probably may be corrected, and probably will have to be corrected at the next session of the legislature, it provides that the commission shall hold public hearings. At the public hearings the property owners in a certain district shall be called in and given an opportunity to be heard as to what sort of a district they desire created; for instance, the property owners in a residence district will be called in; the property owners in a business or industrial, or what we might classify as a nuisance district.

From our experiences in New York and other cities it would seem as though that proceeding would be a failure, that what we ought to have is a comprehensive system, that the commission shall be allowed to divide the entire city up into zones, and that the commission shall determine the character of the zones, that those zone districts shall be immediately put into effect the same as was done in New York, without reference to investigation or consent on the part of the property owners themselves. It worked satisfactorily there; there is no reason why it should not work here. Under the bill as it is drawn now when once a district has been created it will require the consent of eighty per cent of the property owners to change it. We can see that in time, as the city grows or conditions change, that a district, for instance, that is, a business district or a residence district, might eventually have to be changed over into an industrial district, or something of that sort, but that power I think should be vested in a commission. If we get high class men serving on the commission I am sure their judgments will be safe, and it will be entirely proper to trust them with regard to how best to serve the various districts and the various property owners in the districts.

Now the necessity for zoning. That is a question that is frequently asked, and let me say that after our Civil War practically five per cent of our population lived in cities. At the present time fifty-seven per cent of the population live in cities, so that you see this zoning which is going to affect practically every city and village in this country, affects more than a majority of our people. You have all seen a good residence district that has been built up with single family residences. You have seen those districts invaded by apartment or flat buildings. You have seen the value of the single family residences depreciated.

The districts of Hyde Park and Woodlawn are conspicuous examples. The value of the single family residences in these communities has been depreciated by the invasion of apartment buildings until the ground and building occupied by a single residence has been sold for just exactly the value of the land itself. This would never have taken place in the world if the apartment buildings had not been allowed to invade that residence district.

We speak of the changes that take place. The changes usually that take place are the invasion by some undesirable class of improvement into district where they originally should have been kept out. You have seen a district that has been occupied by flat buildings and residences invaded by stores and garages and the little shoe shop, school stores and laundries until the value of the entire property has depreciated more than one-half. Perhaps the most lamentable example of that kind that I know of anywhere in Chicago—it is an old district—is the district between Van Buren and Lake Street from Halsted Street to Racine Avenue. About twenty-five years ago that was one of Chicago's very good residence sections.

There were homes on Washington Boulevard and Jackson Boulevard worth upwards of forty, fifty, sixty or seventy thousand dollars. The entire district was occupied almost exclusively either by open spaces or by residences. Eventually this district was invaded by what we term light manufacturing establishments. They increased in number, and when that invasion took place the better class of owners of property on the two boulevards moved out. The old homes were abandoned or turned over to boarding and rooming houses, some into business houses, and eventually the value of practically all the homes in that district was wiped out. Madison Street, which bi-sects this district, was at that time a first-class business street. The property along that street was worth for business purposes about $800 a foot. At the present time you can buy land, and it is not even salable at this price, along Madison Street for $200 a foot. About 20 per cent of the area in this territory that I mentioned has been given over to factory purposes. There is about 80 per cent of it occupied by old tumble-down, uninhabitable residences. They are objectionable, insanitary and undesirable for home purposes almost entirely. Yet the invasion of 20 per cent of this territory by factories has destroyed entirely the value of all the homes in that district. They have had the effect of wiping out the total value of the residence improvement that amounted to many, many millions of dollars. There were homes in there that should have lasted for one hundred years if the district had been restricted and protected as it would be under zoning. Perhaps some time in the future the city would have grown out and taken in one section after another. When that would have occurred, of course, the district would have been changed over, but certainly the change took place long before it was ever thought of or required to be used for manufacturing purposes. That is evident now when you consider that only 20 per cent of it even now is used for factory purposes. Some of the factories that have gone into this district years ago have grown from small to very large institutions, some of them employing thousands of employes. When you consider that in this entire district there is no switch track or waterway service, and that these factories are compelled to haul their finished product and their raw materials to and from some line of transportation, the factories that are in the district find that the cost of trucking and transportation of their finished and raw products has so increased their overhead expense that many of them are making preparations to abandon the factories they have built, and they are going to move into districts where they can have switch track or both waterway and switch track service. The location of these factories was a mistake, they destroyed a residence district, and now they must move in order to keep down overhead expenses. So you see even the factories, under the proposition of zoning, would be benefitted. Factory owners make mistakes the same as the rest of us. It is an unfortunate idea that a lot of people have that if zoning is made effective in this city it is going to destroy a lot of factory districts and factory properties and injure industry here. The very opposite will take place. The owners of factories need to be protected and directed as to where to locate their plants just as much as the owner of a flat building should be directed to keep out of one district and may be permitted to go into another.

Business in the outlying districts will be benefitted by zoning. Probably in the outlying districts business will be compelled to go along the sections and the half section lines. That is where it belongs. That will prevent the small stores from scattering all over the city and locating in residence and flat building neighborhoods. It will compel stores to go into certain definite business districts. In that way we will have a better class of merchants and more stable values in the outlying business sections.

Now take the loaning value. Mr. Carroll spoke of that. You have often wondered why it is that here in Chicago when you go to make a loan on a piece of property you cannot make it for a period of more than five years. The fact is that your banker knows that a change in the conditions that surround any property is so liable to take place that he wants to have the privilege to come back once in five years and take a look at his security. If he sees that there is no influence that is liable to depreciate the value of that security for another five years, he will renew the loan. If he sees any condition that is liable to depreciate the value of the property, he calls the loan. That is the thing that has been taking place here for years. It is the one thing that has been destroying and discouraging the investment of money in real estate in many localities. It discourages the man who buys a home; some objectionable feature may come into the district or destroy the value that he has worked years to create. Take, for instance, the restricted district that Mr. Nichols spoke of, Rogers Park and Edgewater, or the Highlands on the South Side, the Highlands more particularly. In the Highlands a subdivision forty acres in extent was improved by single residences on fifty foot lots. The lots and residences sold ten years ago for $9,500 to $10,500 apiece. There was a restricted covenant in the deed that made it impossible to build anything on any lot excepting a single family residence to cost five thousand dollars or more. In the Highlands today you cannot, I believe, buy a single residence in that sub-division for less than $18,000, and many have sold for as much as $25,000. The sole reason why this is true is because a man could go in there feeling that he was perfectly secure for at least the average length of a lifetime. He could get in there and feel that he could make an investment and be safe, that his family would be safe, and that the values would be protected.

I saw the other day in Rogers Park one of the most astonishing cases of depreciation I have ever come across, on Granville Avenue just west of Sheridan Road. On three corners, the southwest, southeast and the northeast there were beautiful homes. The house on the southeast corner I would say cost not less than $75,000 to build. On the other two corners the houses cost from $30,000 to $40,000 to build. The entire district for two blocks each way is occupied entirely by fine homes. The northwest corner was vacant.

The restriction that had been imposed on that district had expired and a man had gone in there and was putting up a twelve-story fireproof apartment hotel. I walked around the neighborhood and tried to estimate what the total destruction of values would amount to in the six blocks. As nearly as I could figure it—and I tried to be conservative—there would be an absolute waste of property values of not less than a million dollars. The erection of that hotel in that locality would result in a loss of values about equivalent to the cost of the hotel itself.

I would like to tell you a good deal more about various sections with regard to zoning, the factory districts created in New York City, for instance. They created four districts: residence, business, industrial and nuisance districts. The best authorities now seem to agree that the industrial district and the nuisance district should be one and the same; that it simplifies matters a great deal if you reduce the number of districts. In New York we could see no objections to the four districts, the nuisance districts being occupied by such industries as slaughtering plants and carpet cleaning works and glue factories and soap factories.

Whether this law that we have now on the statute books is constitutional or not is a matter of grave concern. Personally, I think as it now reads it is constitutional. I cannot see from any angle where its constitutionality could be questioned, because it gives the property owner a right to come in and to be heard and to object to the creation of a zone district. In New York, however, they have a better constitution than Illinois; it gives the legislature larger powers to confer authority upon municipalities, which in Illinois unfortunately we do not have under our constitution.

I want to say just a word in regard to the height of buildings. It may surprise some of you engineers to know that from an economical standpoint the high buildings have been proven to be not a commercial success. That was a great surprise to me when I first heard it. The proposition was first worked out by a real estate man in St. Louis, and I think now it is generally conceded by anyone who has studied it and given it careful thought.

When you stop to consider that in our central business district what a wonderful city we would have had if all of the buildings within the central business district would have been limited to six stories in height. We would have had more and smaller merchants; our transportation problems would have been much more easily solved, and we would have had a much finer looking city and less congestion on the streets. In New York City there is now only a very limited area in which they can build high buildings. They tell us there the tendency is even to limit the erection of those buildings which can be built to great height by a set-back proposition. When they go up one hundred feet they have to set-back 20 or 25 feet, and after so many more feet they have to set-back again, and so on until they come almost to a peak, like some of the examples of temples you have seen in some of the pictures of China. I really feel that in the business district in Chicago we are going to have the greatest opposition to zoning. Values here have been created which are fictitious, owing to the intensive use of lots in the downtown district, and when we come to limit the height that a man may build a building in the downtown district, it is going to depreciate the value of all the other unoccupied land very materially, and those property owners are going to put up a desperate struggle to prevent anything of that kind happening, because it will mean a destruction of values.

February 5, 1920

City Zoning in Chicago—*Continued*

By Mr. William Artingstall, M. W. S. E.

THIS meeting was arranged after the aldermen, some ten or twenty of them, belonging to the "Committee on Buildings and City Hall" and the "Committee on Streets and Alleys," had made a tour through several of the Canadian cities in the interests of zoning. As you know, an ordinance has been presented, or a statute has been presented and passed at the last legislature, and an agitation was made here in the city. There is an ordinance being prepared, and I believe referred to the Committee on Buildings, providing for the zoning of the city. In order to gather as much information as possible, this committee, together with the Streets and Alleys Committee made this tour and invited representatives of several civic organizations, among them the Western Society of Engineers, and the time which was necessary to make a report was hardly sufficient, so I suggested to Mr. Nethercut that rather than have a report from the one representative of the Western Society who was on this trip, that we have a few remarks from each of the civic members and others who had made the tour with us.

You know engineers are pretty liberal. Some take their Scotch first and sometimes last, so I thought I would put him in the middle tonight. Mr. Carroll spoke about the values of property depreciating due to either residents coming into industrial sections or industrial plants moving into residence sections. When we were down in New York one of the prominent members of the Commission took us on a trip around the whole city and Brooklyn, and spent practically a day with us, and he kept harping continually on values appreciating due to the zoning law, and I said to him, "Mr. Bassett, ever since we have listened to you you have said that values have gone up very materially due to the zoning law. Now I don't know an awfully lot about it, but I am an engineer and would like to know more about it, and be shown the facts. If there is any place in the city of New York where you can point out where the value has actually increased, if it is on our road, I would like to see it, and if it is not on the trip as mapped out, give me the address and I will find it and look at it myself." Without saying another word to me he spoke to the driver—we were in one of these "rubberneck wagons"—and the driver turned off the main line a ways and stopped. He said, "One of the gentlemen has been talking to me about values. The question arose as to whether any place in the city of New York I knew personally that the value had been increased." He said, "There," pointing on his right-hand side to a building which here in Chicago would cost probably $17,000 or $18,000, "is a building I had up for sale sometime ago for $22,000, and I couldn't get a purchaser. The zoning law went into effect and I sold it for $35,000." I said to him, that satisfies me, thank you."

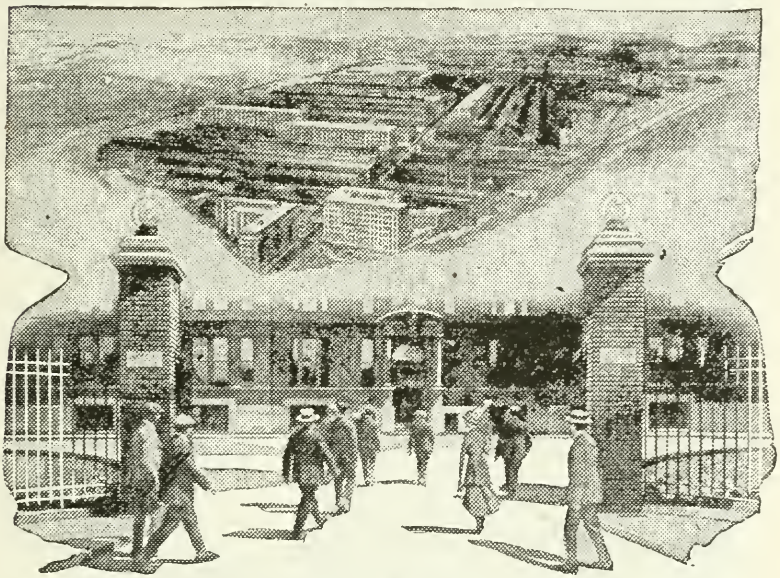
Mr. Ackley spoke about the growth of cities, and Mr. Hammond also spoke about the mosaic map, which the government has agreed to make on payment of gasoline. It may be interesting to know that some years ago I had access to a book published along about 1600 and something, on the Growth of London, and the writer at that time went on to prove that the city of London, and in fact no city, could be built to exceed 700,000 people; that the economic conditions surrounding absolutely preculded it; people could not get out of a city of over 700,000 in order to get produce, and produce could not be raised within a distance of twenty miles to feed the people inside the city. Of course he didn't have the same idea that we have at the present time of transportation, but Mr. Hammond and Mr. Ackley have somewhat larger views and can see a city extending from Great Lakes down to Gary on one side and from Lake Michigan out to the Pacific on the other. That may be stretching it a little bit, but not so very much. The engineers, you know, always confine themselves to the truth. They are always in demand, even by the Real Estate Board.

You have heard the speakers this evening, and after these talks I think you are perfectly willing to dispense with the report of the engineer. But if you will consider zoning merely as the partitioning of real estate to its economic use, you have the whole thing in a nutshell, whether it be for industry, commerce or for residence purposes.

The one feature which was not spoken of this evening was our trip around the country, that is, through Canada and the East. We left here and went to Toronto, it being one of the first cities on our line. There we saw the example of piecemeal zoning; residences would be built similar to what you have seen here, and right next door to them would be a school, store, or a delicatessen or something else. Then we went to Ottawa, where they hadn't done very much they could show us, except a good time, which they did right royally. At Montreal the day was so wet and rainy it was almost impossible to do anything except sit in the hotel and wait for tomorrow to go down to New York. You have had New York described to you. As it was on our way we paid a little visit to Newark, where they were giving a great deal of attention to the industry. Philadelphia had put into effect a zoning law, or rather, under the statutes of the State they had developed a zoning ordinance which had been conceived in secret, born in secret and was to be exposed the next day. That happened to be the day we were there. One of the gentlemen who is very actively concerned in it said, "We have worked two years on this thing; nobody knows anything about it. I got a telephone communication last night that I could give it out to you gentlemen today, and also to the press, and I was down at 4:30 this morning trying to get my maps together and figure out how I was going to present it, and whether it goes through or not I don't care."

At Cleveland we saw a different condition. Mr. Whitten, a very able statistician, had gathered his data together under a mixed commission, who paid very little attention to it. Mr. Whitten was amply able to carry on his part of the work, but should have had the local co-operation. One of the members of the commission acknowledged that he didn't know anything about what was going to be done. We then went down to St. Louis and in contrast to some of the other places, saw wonderful co-operation. The different members of the commission who spoke to us said, "Well, we don't know very much about this, but we are learning every day, and we are going to let our engineer speak to you on the question, and you can bet your life that whatever he says we are going to back him up in." That is just an example of how this kind of work should be carried on, and how the different commissions should be working. It is up to the commission themselves. We went through St. Louis, and Mr. Ball has shown you a good deal of it, and Mr. Hammond and Mr. Ackley spoke considerably on it. There was also another gentleman who was a member of a party to go to St. Louis, and also New Orleans, although he was not with us at the time, but you all know him. I would like to call on Alderman Fisher, Chairman of the Local Industries Board, to give us his views of zoning in the various cities that he visited.

I have served on a number of commissions, both in this city and elsewhere, and I have never had such work in my life as trying to get something that will help me from men in some other city. I am not acquainted with men who are familiar with their local problems, and they are not acquainted with me. They may see a little notice in the paper that Artingstall is down there doing something, and they think that is fine, but that's as far as it goes. Here in Chicago we have gone through hundreds of commissions and committees and everything else. We have a number of studies. There are a number of men here in Chicago who are able to carry on that work with the aid of the consultant's expert in certain lines, just as well as anybody from outside. I was glad to see Alderman Fisher come out in the same way, in line, of course, with the industry. There is no question about it. We have a commerce here that other cities do not have. The principal thing when you get right down to it is that if you don't have healthful surroundings neither the industry nor anything else is going to prosper. That applies also to the industry itself. I firmly believe there is no more necessity of having a residence in the heart of the industrial zone than there is of having a laundry out by my house, and if you go to work and adopt the piecemeal zoning which some people are advocating, that is just the situation you are going to create. If that laundry is put where it belongs, all well and good, but if you let them come out by my residence and put up their laundry, I'm going to kick up some opposition that somebody is going to hear about.



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SAFETY COUNCIL ORGANIZES ENGINEERING SECTION

Organization of the Engineering Section of the National Safety Council has been perfected it is announced.

C. P. Tolman of the National Lead Company was elected permanent chairman of the section. L. A. DeBlois of E. I. du Pont de Nemours & Company was elected vice-chairman and Sidney J. Williams, secretary and chief engineer of the National Safety Council was elected secretary.

The membership committee is now ready to receive applications for membership in the Engineering Section. All such applications should be addressed to headquarters of the National Safety Council in Chicago.

The executive committee of the section voted to increase its membership by the addition of Professor Roberts and Dr. E. B. Rosa of the United States Bureau of Standards and by an engineer from each of the industrial sections of the Council not already represented on the executive committee. The chairman of each section will be asked to select its representative on the executive committee of the new Engineering Sec-

(*Continued on page* 27)

BOARD MEETING

The Board of Direction met at 4:30 p. m., February 9, 1920. Owing to the absence of Mr. F. K. Copeland, president, Mr. C. F. W. Felt presided.

The minutes of Board meetings of January 12, 23 and February 3 were approved. The Secretary presented the following applications for membership in the Society, received since January 23:

16 Ethel L. Funk, Miss, Oak Park, Ill.
17 Harry E. Hershey, Chicago, Ill.
18 Corinne Pearson, Miss, Des Pleaines, Ill.
19 D. Talcott, Miss, Chicago, Ill.
20 Charles Edward Drobnyk, Chicago, Ill.
21 Oscar William Kayser, Chicago, Ill.
22 Byron S. Powell, Melrose Park, Ill.
23 Charles Henry Van Dyke, Berwyn, Ill.
24 Norman Lester Weber, Chicago, Ill.
25 Reeve O. Strock, Chicago, Ill.
26 Albert G. Timins, Lake Forest, Ill.
27 William R. Johnson, Geneva, Ill.
28 Edgar Rice Hill, Algonquin, Ill.
29 Marjorie A. Keeler, Melrose Park, Ill.

(*Continued on page* 19)

HYDROLOGY

By Daniel W. Mead,
M.AM.SOC.C.E., M.W.S.E.
Professor of Hydraulic and Sanitary Engineering, University of Wisconsin

Reviewed by Murray Blanchard,
M.AM.SOC.C.E., M.W.S.E.
Hydraulic Engineer, Division of Waterways, State of Illinois.

This book is a valuable contribution to engineering literature for it treats, in a well written, clear and comprehensive volume, of a subject that is fundamental in hydraulic engineering.

In the introduction are noted some of the recent serious casualties that have resulted from failures due to neglect to investigate the fundamental hydrological conditions or to appreciate the importance of a knowledge of same.

The purposes of the study of Hydrology are outlined and among these are "to ascertain the effects on hydrological phenomena of the various physical conditions that obtain in any locality, and to investigate the geographical limitations within which the observed phenomena may be applied with greater or less modifications, also to establish, as far as may be, such laws as will aid in the determination of the effects to be expected from other physical conditions which are found to obtain."

The author states that he does not hope to offer a complete treatise on the subject, but only to point out the general relations that have been established, the general principals that are involved, and the necessity that exists for further research and study before the concrete problems can be solved even approximately.

At the ends of chapters are given extensive references to published literature on the subjects treated of in the text.

In one chapter, winds and storm movements and weather forecasting are discussed and illustrated with numerous curves taken mainly from Bulletin No. 20, U. S. Weather Bureau on this subject.

To the important subjects of precipitation and rainfall are devoted 150 well illustrated pages. Apparatus for the measurement of rainfall is described, and information is given as to the methods of making the measurements and keeping the records.

In the chapters covering the subjects of Geological Agencies, Drainage Valleys and Channels, Geology, Ground Waters and Wells, is found data especially useful in the study of water supply problems.

Over 100 pages are devoted to another important subject, that of Runoff and the methods of estimating same. The determination of the flow of a stream is referred to as an important but difficult problem. The extent to which the subject of Runoff is covered would warrant a few pages here on the subject of the measurement of the stream flow. The references given by the author in his second edition of "Water Power Engineering" to stream gauging pp. 137-138 are more comprehensive and might well have been referred to in this volume.

Floods and Flood Flows, a subject having an important relation to the matter of investigations for hydroelectric developments is discussed at length with numerous curves indicating the methods of studying floods and of storage.

The successful man in business today is the one who studies the human element.

EXPLOSIVES SNUFF OUT GAS WELL FIRE

What is conceded to be the largest gas blaze ever encountered in the oil producing industry occurred at one of the Standard Oil Company's wells near Taft, California, July 26th, 1919. With a flow of 180,000,000 cubic feet of gas every 24 hours, shooting upward under enormous pressure, the well blazed for ten consecutive days and nights. All known methods of extinguishing it were tried and proved of no avail, until the plan of putting it out with explosives was submitted and tried.

The Standard Oil Company was drilling with a rotary drill. The well was at a depth of 2,135 feet in 10-inch casing, when a supposed water sand was encountered. To test this sand for water, the mud in the well was bailed down to relieve pressure, and to allow any water present to accumulate in the well. During the course of bailing the well blew out under tremendous pressure and the greatest flow of gas in the history of oil production began.

The drilling crew attempted to get the well under control by closing the 12½-inch gate valve with which the casing was equipped, but the shale and sand carried by the stream of gas cut out the seat of the valve while the gate was being closed, and the well continued to blow. Two hours after the flow began the friction caused by the shale and sand had produced a red hot heat on the casing, and the gas, igniting, burst into a column of fire, gushing three hundred feet skyward. Its maximum width of about fifty feet was reached after the flame traveled about one hundred feet upward. The gas emerged from the casing with such force that for a distance of twelve feet about the casing there was no flame.

Metal, while within a radius of fifty feet of the casing, was reduced to a white heat. A thermometer, registering 300 degrees F., broke at a distance of 250 feet from the fire.

Men could not hear each other shouting within a radius of one thousand feet of the well, and deafness resulted among the fire fighters. All plans were carried out by signals.

The first attempt to extinguish the fire was made July 27th, by the assembling of ten boilers. From both the blowoffs and the steam connections of these boilers three-inch lines were laid to within fifty feet of the well where each branched into two-inch lines and ran to the base of the flame. With the base of the flame twelve feet above the ground level, the work of laying these pipe lines, nevertheless, became a matter of human endurance against heat. The men worked behind large portabe metal screens, with a stream of water constantly playing upon them from a three-inch fire hose. Water lines were also laid, and with the boilers and pumps throwing steam and water into the flame to their full capacity there was no noticable effect upon the fire.

Shortly after all the casing above the ground blew off, and the well began to crater, allowing the flame to draw down to the ground level.

The second attempt was made with the full capacity of sixteen boilers and four pumps throwing steam and water through three and four inch lines, but this effort showed no more results than the first.

The third attempt was made with thirty boilers throwing steam and water, four rotary pumps throwing water, two 125-barrel tanks with four-inch steam jetted lines and two pumps throwing fire foam.

Officials of the company brought artillery officers from the Western Department, U. S. Army, who considered bombarding the well with field howitzers, but who reported that portable artillery was too small in calibre to accomplish the task.

Thus through the fatiguing efforts of nine days and nights, in which time the company expended nearly a half million dollars, they arrived at the point where all efforts seemed in vain, and had reached the end of their resources.

The company then considered the idea of conquering the fire by explosives.

Two derricks approximately forty feet high were built on either side of the burning well and so far away that the heat would not destroy them. A 9/16-inch steel cable was attached to the top of one of them, then laid around the well outside of the terrific heat zone, to the other derrick where it was run through a pulley at the top and the end attached to the drum of a small winding engine underneath. The explosives, bound in one package and covered with heavy sheetings of asbestos, were securely attached to this cable at the same distance away from the first derrick as the burning well was The explosives, before being made up into this package, had been primed electrically. When this was done, the engine under the second derrick began drawing the cable taut which pulled the explosives toward the well and at the same time hoisted them. When they had reached the proper spot they were exploded electrically. It is unnecessary to state that this had to be done very quickly so as to bring the explosive charge to the necessary point before they were ignited or exploded by the heat from the burning well.

Eye witnesses at a great distance state that when the package exploded the gas well fire was divided into three sections. The section at the point of explosion was moved bodily away from the column of gas in a horizontal direction, the upper section was blown upward and beyond danger of reignition of the gas column, while the lower section was snuffed out very much as a candle is snuffed out, the flow of gas being temporarily checked.

To get an idea of the enormous amount of gas flowing from this well one has but to note that the entire city of San Francisco consumes but 22,000,00 cubic feet of gas each day, and that this well alone would supply more than gas enough for eight cities the same size.

In the future gas well fires, oil well fires and oil reservoir fires will be extinguished with explosives at a small comparative cost to what has heretofore been expended.

What are you doing to increase production?

BOARD MEETING

(*Continued from page* 1)

30 William F. Drews, Chicago, Ill.
31 Fred G. Frederick, Chicago, Ill.
32 Roland Stoecks, transferred from Student, Chicago, Ill.
33 Norman J. Shutz, Geneva, Ill.
34 Harry J. Holmquist, Oak Park, Ill.
35 William J. Morden, Chicago, Ill.
36 Derwood S. Chase, Chicago, Ill.
37 E. E. Maher, Chicago, Ill.

It was reported that Messrs. Fowle, Shepherd and Baldwin have accepted appointment on the Finance Committee.

The following were elected to grade of membership indicated:

17 Miller, Richard Gladden, transferred from Jr., Box 570, Huntington, W. Va. Member.
156 Dugger, Donald O., 3240 South Michigan Blvd. Jr.
282 Olson, Elmer H. Reinstatement. 1033 Railway Ex. Bldg. Member.
745 Campbell, E. E., room 642, 72 W. Adams St. Member.
747 Croy, H. C., room 700, 72 W. Adams St. Assoc.
749 Schultz, Louis G., room 628, 72 W. Adams St. Assoc.
750 Frankel, Chas. B., room 628, 72 W. Adams St. Assoc.
875 Benson, George W., 6121 Ellis Ave. Member.
914 Cameron, A. H., 40th St. and Princeton Ave. Member.
926 Lonnecker, G. V., 310 E. 68th St. Member.
1021 Elliott, John S., 208 S. La Salle St. Member.
1040 Wheeler, B. C., 111 W. Washington St. Assoc.
1046 Piersol, J. A., 6520 Kenwood Ave. Jr.
1112 Buck, N. E., 72 W. Adams St. Com. Ed. Co. Assoc.
1118 Norman, Charles Morris, 447 E. Illinois St. Member.
1286 Avery, Guy T., 6626 University Ave. Jr.
1665 Singer, Roy M. 2325 N. Kedzie Ave. Student.
1666 Peterson, Geo. W., 3251 Michigan Ave. Student.
1667 Rosback, Lee H., 643 W. 60th St. Student.
1668 Mann, Herbert A., 5526 N. Clark St. Student.
1669 Lyon, Wm. Kimball, Jr., 927 E. 40th St. Student.
1670 Appelbaum, A. L., 2255 Walton St. Student.
2077 Kumbera, Geo. C., 1465 Bryn Mawr Ave. Student.
591 Marklin, Fred W., 1559 Sheffield. Jr.
874 Clarahan, Charles Jr., 822 N. Euclid Ave., Oak Park, Ill. Jr.
921 Campbell, Julian C., 20 S. Hoyne Ave. Assoc.
964 Perham, D. E., 537 Monadnock Bldg. Member.
986 Engstrom, Geo. E., 6568 Lakewood Ave. Member.
990 Ward, Stuart T., 723 Michigan Ave., Evanston, Ill. Rejected.
1546 Schupp, John X., 1906 S. Harding Ave. Assoc.
1661 Kramlich, Charles W., Jr., 5922 W. Erie St. Jr.
1697 Ruchti, Lescher, 1516 Rosemont Ave. Member.
1777 Lambert, C. A., 22nd and Fisk Sts. Assoc.

The annual report of the Program and Publication Committee was received. The committee's recommendation that a sub-committee on publication be organized was referred to the Committee on Committees.

A plan of co-operative arrangements between the W. S. E. and the A. S. C. E. was received and referred to the Committee on Affiliation.

J. L. Hecht, William Artingstall and A. W. Dilling were appointed as a special sub-committee of three Board members to report on the present status of the Chicago Traction Commission and its plan of operation.

The secretary reported the net increase in membership from January 1, 1919, to January 1, 1920, to be 722, there being 1,816 members on the rolls of the Society on the last named day.

Mr. E. T. Howson was appointed Assistant Secretary for the present year.

The death of Mr. Roy W. Flowers, Associate W. S. E., August 10, 1912, was reported.

Mr. Wm. Artingstall announced that the Association of Commerce desired a committee from the Society to examine the plans of the City Engineer for Water Works Improvements, jointly with a committee from the Association. The chairman was instructed to appoint such a committee.

Edgar S. Nethercut, *Secretary.*

R. E. S. Geare has been appointed General Sales Manager of the T. L. Smith Company of Milwaukee, manufacturers of concrete mixing machinery and contractors' equipment. He will be in charge of the company's general sales offices, Old Colony Building, Chicago, where the advertising and sales departments are now located.

Mr. Harold Almert, M. W. S. E., a prominent engineer of Chicago, addressed a meeting on January 18 at the Central Y. M. C. A. Auditorium under the auspices of the Junior Association of Commerce. Technical branches of twenty-three high schools were invited to attend.

THE GOAL*

It has been stated that this country is money mad. Basis for the statement that we are money mad is on the frequent sparseness of attendance at scientific and technical meetings and the difficulties in finding men who will devote the necessary time to the preparation of a program to make a meeting of especial interest.

Whether or not our interest is lacking in matters of general cultural and scientific interest, it is opportune for each one of us to stop, consider and take council regarding whether we, as individuals, are unduly shortsighted in matters relating to the broadening of the breadth of our mental vision.

That we should lose sight of our responsibility to the community and place undue emphasis on the procurement of the dollar is possibly only natural and at this time easily explainable. In a large measure it is doubtless due to the depreciated value of the dollar and to the difficulty which each one of us is having because of this fact in maintaining our former standard of living. Yet in spite of this very plausible explanation it only behooves each one of us to work all the harder for those things which cannot be purchased with dollars. It is at this time that true character shines out and we can rest assured that those who have not lost sight of matters of general and scientific interest will stand out as leaders today and be recognized as leaders in the days to come.

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* Extracts from an article by Mr. A. E. White, printed in the Proceedings of the Steel Treating Research Society.

The 16th Annual Convention of the Southwestern Electrical and Gas Association will be held in Galveston, Texas, May 13, 14 and 15.

TWO NOTABLE BOOKS ON INDUSTRIAL HOUSING

Report of the United States Housing Corporation, Volume II, Houses, Site-planning, Utilities. Copies obtainable from the Superintendent of Documents, Government Printing Office, Washington, D. C. 524 pages, 9x12 inches, illustrated. $1.50.

Homes for Workmen—A Presentation of Leading Examples of Industrial Community Development. The Southern Pine Association, New Orleans, La. 250 pages, 9x12 inches, illustrated. $1.00.

By far the largest group of housing enterprises ever carried on in this country under one head was that of the United States Housing Corporation, undertaken during the war to help to relieve some of the worst cases of housing shortage in "munitions" communities. The work of the Housing Corporation was planned and directed by some of the ablest men in the country on the various architectural, engineering, town planning and financial problems involved; and while the early conclusion of peace prevented the completion of much of this work, the actual accomplishments of the corporation, as outlined in this report, are of the greatest possible value to every one interested in industrial housing.

The report describes the procedure followed in selecting and developing the site of each project, and designing and constructing the houses. At least half of the report consists of photographs and plans—plans of complete projects, showing topography, street layout, water and sewer systems, etc., and plans of individual houses, rows and apartments of various sizes and types. The appendix contains a table of costs and the various standards used. An interesting feature is the chapter of "general observations" (page 68), which contains a frank statement of the criticisms which have been made or might be made of certain features of the houses; these features were considered necessary by reason of the war-emergency, but should not be adopted as a standard in future projects.

The book of the Southern Pine Association is based on the premise that "a difficult though insistent problem confronting industry today is that of proper living conditions for workmen and their families, to insure the adequacy, stability and efficiency of labor. . . . Community housing enterprises, undertaken along proper lines, will avoid the methods of speculative builders, and will not find their incentive in the earning of large dividends and profits to investors."

The opening chapter, by John Nolen, emphasizes the importance of choosing a desirable tract of land, which must not be too expensive, and adapting the street layout to the topography rather than following the usual gridiron system. The detached house for one family, with a minimum of four or five rooms, is recommended; if rows are necessary they should never be more than two rooms deep.

Other chapters, by other writers, deal with methods of financing a housing project; the "co-partnership" plan developed in England; the venture of the State of Massachusetts in building a number of low cost homes for working men at Lowell; the recommendations of the National Board of Fire Underwriters, on reducing the fire hazard in frame houses. Reprints of two reports by Leifur Magnusson of the United States Bureau of Labor Statistics, are included. Between these chapters are interspersed more or less detailed descriptions of twenty-four housing developments carried out recently by individual employers or by groups of employers in a community.

Toward the end of the book there is a chapter setting forth the advantages of southern pine as a building material for houses; and, so far as noticed by the reviewer, the book does not mention any of the housing projects in which reinforced concrete was used as the principal material. Aside from this fact, the presentation is entirely impartial. The typography and general appearance of the book are excellent.

The following papers will be read at the 16th Annual Convention of the Illinois Gas Association, March 17 and 18:

"Friendly Relations with the Public," B. J. Mullaney, Chicago.

"Quantity Consumption and its Effect on Customer's Rate," S. B. Cushing, Chicago.

"Utility Accounting in Illinois," W. J. Achelpohl, Peoria.

"Appraisals and Rate of Return for Utilities," W. J. Hagenah, Chicago.

"Recent Developments in Industrial Uses for Gas," J. H. Gumz, Chicago.

"House Heating by Gas," P. M. Spies, Chicago.

"Appliance Sales," J. E. Davies, Chicago.

"Gas Purification," W. A. Dunkley, Urbana.

"Relative Efficiency of Gas and Electricity for Industrial Purposes," A. Herz, Chicago.

"Location of Large Gas Generating Station in a Coal Mining District." Discussion.

"What are You Doing to Reduce Operating Expenses?" Discussion.

HOUSING EXHIBIT IN NORWAY

An exhibition under the auspices of the Norwegian Housing and Town Planning Association will be held from April 19 to May 3 in Christiania, announces the Consul-General there. Materials necessary in erecting residences will be shown. American concerns are invited to take part, as well as manufacturers of other countries.

"One of the most difficult things we have to accomplish today is to convince labor that all surplus in commodities is obtained from *production,* not from capital. No matter what hours we work and no matter what pay we get in *dollars,* our *real wages* are measured by the quantity of *things* there are to divide and by the size of the surplus after our necessities have been obtained," says John Calder, manager of employes' relations, Swift & Co.

The Carnegie Corporation of New York will give $5,000,000 for the use of the National Academy of Sciences and the National Research Council. It is understood that a portion of the money will be used to erect in Washington a home of suitable architectural dignity for the two beneficiary organizations. The remainder will be placed in the hands of the Academy, which enjoys a federal charter, to be used as a permanent endowment for the National Research Council.

Both houses of Congress are giving attention to Federal aid to good roads. Secretary of Agriculture has recommended that an additional $100,000,000 be made available for each of four fiscal years beginning 1922.

ANALYSIS OF STATICALLY INDETERMINATE STRUCTURES BY THE SLOPE DEFLECTION METHOD

Bulletin 108, Engineering Experiment Station, University of Illinois

By W. M. Wilson, F. F. Richart, Camillo Weiss.

This bulletin consists of a mathematical analysis of the stresses in statically indeterminate structures. The structures considered include continuous girders, two legged rectangular bents, trapezoidal bents, three legged bents, rectangular frames, and office building frames.

The stresses are analyzed by the slope deflection method based upon the work of Otto Mohr and C. E. Greene as developed by Manderlo, Mohr, Kunz, and Wilson and Money.

The feature of the work which is entitled to especial attention is the separation of the moments in a member into two parts. One part depends upon the physical and geometrical properties of the member and the restraint of the ends of the member. The other part depends upon the external load to which the member is subjected. To illustrate, consider the case of a two-legged rectangular bent with equal legs and carrying any system of vertical loads on top. If the legs are hinged at the bases, the moment at the end A of the top member AB is given by the equation

$$M_{AB} = \frac{3}{10n}\left[C_{AB} + C_{BA}\right]$$

in which C_{AB} and C_{BA} are constants depending upon the loading on the member AB. Values of the constants C are given in the Bulletin for all types of loadings. In this way equations were derived for determining stresses in a large number of structures due to any system of loading. By substituting proper values of C the equations are applicable to the same frames carrying any specific system of loads.

Some statically indeterminate structures have been analyzed which are of special interest. The usual one-span girder with fixed ends (tangents to the elastic curve at the ends horizontal) has been modified to include the case in which the ends of the girder are restrained but are not fixed. That is, rotation at the end of the girder is resisted but not prevented entirely. Likewise, the case is considered in which the supports are not on the same level. These modifications are carried throughout the treatment of continuous girders.

The effect of settlement and heaving of foundations is considered in the treatment of continuous girders, two-legged and three-legged bents. This treatment of two-legged bents should be of special interest to a designer of bents and towers.

A number of illustrative numerical problems are given. These include the following: Moments in a four-span continuous girder with restrained (not fixed) ends, where the supports are all on different levels, the lengths of all spans are different; and the loads on all spans are different; moments in a two-legged rectangular bent with fixed bases and a uniformly varying distributed load on both legs (in reality, a section of a concrete culvert partly submerged in water); and moments due to settlement of the foundations of a two-legged rectangular bent with fixed bases.

The bulletin includes a tremendous amount of material and should be of great value to an engineer designing statically indeterminate structures.

The bulletin contains 214 pages.

JOURNAL
OF THE
WESTERN SOCIETY
OF
ENGINEERS

"To promote and advance the science and art of engineering."

EDITORIAL

Women are entering the technical professions in gradually increasing numbers. At present their labors are confined chiefly to the drafting room. But as time goes on they will undoubtedly take up duties as executives in engineering organizations and engage in private practice as consultants.

This activity brings before the Western Society and other engineering organizations the question of whether or not the term "engineer" shall be confined entirely to the "male of the species."

Five women have applied for Student Membership in the Western Society on the basis of their education and experience. There would seem to be no provisions of the Constitution to prevent them from becoming members of the Society, provided they meet the qualifications necessary for admittance. The Constitution says on this point:

"Art. III, Sec. 6. A Student Member shall, at the time of his admission be an undergraduate in the Junior or Senior year of an engineering school of recognized standing. His connection with the Society shall terminate with the calendar year following the one in which he becomes eligible to Junior Membership, and not in any case later than the end of the third calendar year after his admission, unless previously transferred to another grade."

It would seem then that the broad meaning of the Constitution is applicable in this case. For work of equal merit, women deserve recognition equal to that accorded their male contemporaries now members of the Western Society.

LONDON CORRESPONDENCE

By W. E. WOOLLEY

Military and naval authorities are reported to be in favor of the Channel Tunnel Project, connecting England and France.

It will take five years to complete the work at an expense of approximately $150,000,000.

The value of the proposed tunnel to industrial development has been recognized by all branches of the British government.

The project was first suggested in 1802, but due to political difficulties, it never received serious consideration until now.

Newspaper accounts of the settlement of a strike at the plant of the Standard Steel Car Company, Hammond, Ind., stated that the company had conceded to the demand of the strike leaders for the abolition of the shop representation plan.

Mr. P. G. Jenks, assistant to the president of the company, writes that the newspaper report was erroneous and that the shop representation plan still is in operation.

Sanderson and Porter, Engineers, have issued a booklet descriptive of the "New Water Supply System of Victoria, British Columbia." The reading matter is illustrated with photographs and diagrams of the project.

EMPLOYMENT SERVICE

NO CHARGE is made for opportunities announced in this section of the Journal.

ANNOUNCEMENTS must not be more than sixty-five words in length and will not be inserted more than twice during a period of two months, during which time all records will remain in the active files. All correspondence will be treated confidentially.

APPLICANTS for situations, not members of the W. S. E., must have card of introduction from a member of the Society.

ALL REPLIES should be addressed to the key number indicated, in care of Employment Bureau, Western Society of Engineers, 1735 *Monadnock Block, Chicago.*

SITUATIONS WANTED

CAPTAIN ENGINEERS, GRADUATE M. E., five years consulting and contracting engineer, wants executive position. Age 40. Salary expected, $5,000. References on application. Address B-102.

CIVIL ENGINEER, eight years experience, wants position as construction superintendent or inspector. Age 31, single. Salary $200 to $250 per month. Address B-103.

GRADUATE M. E., age 40, married, desires position as factory superintendent or production engineer. Now in employ of U. S. government. Address B-104.

GRADUATE C. E., twelve years experience in design, detail and estimates for bridge and building structures of steel and reinforced concrete, wants position as superintendent of construction. Age 32, married. Salary $250 to $300 per month. Address B-105.

GRADUATE CRANE TECH., age 24, single, desires situation with industrial concern, contractor or consulting engineer; salary considered secondary. Address B-106.

GRADUATE ELECT. ENGR., age 27, married, wants position as power plant engineer or work in connection with industrial plants. Salary $300. Address B-107.

GRAD. RY. ELECT. ENGR., 11 years experience elect. and mech. construction; age 33, single; salary $3,000. Capt. U. S. A. 2½ years. Address B-109.

GRAD. M. E., four years experience, desires position where executive ability is required, eventually leading to executive responsibilities. Salary $2,600 to $3,000. Address B-110.

ENGINEER desires position with railway supply house. References furnished. Address B-111.

GRAD. C. E., married, ten years experience editorial and construction work, wants position as editor of construction paper, manager concrete products shop or construction expediter. Address B-112.

YOUNG MAN, 3½ years mechanical draftsman, wants position for machine designing. Salary $140. Address B-113.

GRADUATE C. E., two and a half years experience, now employed by western railroad as designer and estimator, wants position outside of railroad field. Age 28, single. Address B-114.

CHEMICAL ENGINEER, is fitted for position as salesman or adjuster for firms selling chemical machinery. Salary plus commission. Wants opportunity to show initiative. What have you? Address B-116.

EXPERIENCED E. E. wants position as executive with public utility corporation. Best of references. Salary $2,000 to $2,500. Address B-117.

ENGINEER with experience in supervision of field construction accounting offices, now with U. S. Housing Corporation, desires change of location. Salary $3,500. Address B-118.

I WANT A POSITION in sales engineering department of concern manufacturing electrical equipment. College graduate. Twelve years experience. Salary expected $3,600. Address B-121.

MECHANICAL ENGINEER, 25 years experience, wants to change position. References on application. Salary $3,600. Address B-122.

ELECTRICAL ENGINEER, experienced in supervision of electrical layouts for power plants and substations, industrial buildings and overhead and underground distribution, wants to change position where greater opportunity is offered. Salary $3,000. Address B-220.

CAPT., U. S. A., experienced in concrete construction. sewerage, water supply and drainage, wants position with industrial concern. References on application. Address B-221.

MAJOR ENGINEERS, U. S. A., recently discharged—now employed —is familiar with all phases of construction projects; desires position as supt., office executive or sales engineer. Good organizer. Address B-222.

CIVIL ENGINEER wants position with commercial organization where technical training will be of value. Experienced as construction executive. Address B-223.

GRAD. MASS. INST. TECH., desires position with manufacturing concern requiring services of mech. engr. in developing and originating specialties, planning methods and systems. Experienced in design of cranes, hoists and general equipment. Address B-224.

CIVIL ENGINEER wants to identify himself with organization engaged in engineering research or construction or with firm manufacturing commercial product requiring engineering services. Experienced in valuation work. Address B-225.

GRADUATE ARMOUR INSTITUTE, experienced in construction and estimating, wants position that will develop into sales engineering work. References on application. Address B-226.

MAN EXPERIENCED in field engineering and direct charge of important construction wants position as field engineer. Best of references. Address B-228.

ENGINEER who considers salary of secondary importance wants position with machinery manufacturer in Chicago. Recently discharged from army. Address B-229.

MAJOR ENGR'S., U. S. A., with general engineering experience, wants to locate in Chicago. What have you to offer? Address B-230.

ENGINEER wants position in Montana or Wyoming. General experience. Address B-231.

ENGINEER now employed by government desires position with industrial organization. Must increase income. Address B-232.

WHAT HAVE YOU TO OFFER in structural engineering, drafting, designing or estimating lines to an engineer of varied experience now employed by large Chicago corporation? Address B-233.

EMPLOYED IN DIVISION ENGINEER'S OFFICE, western railroad; wants position in West, preferably Arizona. References on application. Address B-234.

ENGINEER, civil, wants opportunity to increase income and broaden experience. References. Address B-235.

SITUATIONS AVAILABLE.

FOUR MECHANICAL ENGINEERS needed at Ford Plant, Detroit. Ideal conditions. Address A-1.

WANTED—TWO DESIGNING ENGINEERS, experienced with reinforced concrete and TWO MECHANICAL DRAFTSMEN. Address A-2.

WANTED—SALES ENGINEER with large organization in city. Address A-3.

WANTED—MECHANICAL DRAFTSMAN experienced on car work, preferably engaged in past in steel or malleable iron foundry. Address A-4.

MAN experienced as cost engineer to work on public service and municipal accounts is needed by large organization of industrial engineers. References required. Salary commensurate with ability. Address A-5.

WANTED—ONE MECHANICAL DRAFTSMAN and ONE MECHANICAL ENGINEER to make efficiency tests of boilers. Needed at once. Address A-6.

ONE STRUCTURAL DESIGNER, TWO GENERAL DRAFTSMEN, ONE SANITARY ENGINEER, first class only, wanted by waterways commission. Address A-7.

WANTED—CHIEF DRAFTSMAN familiar with reinforced concrete design. Salary reasonable. Address A-8.

RESPONSIBLE COMPANY wants high grade sales engineer. One who has had stoker experience. Address A-9.

WANTED—INSTRUCTOR IN SURVEYING in school of engineering near Chicago. Salary $1,400 to $1,800, depending upon experience and ability. Address A-10.

WANTED—ENGINEER who has had experience with heating and ventilating plants to handle sales of hot air heater for factories and large offices. Address A-11.

RESPONSIBLE ARCHITECTURAL FIRM wants experienced concrete engineer familiar with design of buildings. Address A-12.

WANTED—MAN 25 TO 30 YEARS OF AGE to take position as superintendent in electric lighting plant in Iowa. General superivision of office and system. Salary about $175, depending upon man. Address A-13.

WANTED—BUSINESS CONTRACT AGENT for electric light plant in city of 50,000, 200 miles of Chicago. Salary $200, depending upon qualifications. Address A-14.

ORGANIZE ENGINEERING SECTION

(*Continued from page* 1)

At the organization meeting the executive committee of the section discussed what part the Council and the Engineering Section should take in the formulation of standards under the general auspices of the American Engineering Standards Committee and in co-operation with the Bureau of Standards. No attempt was made to formulate a definite program. It seemed to be the opinion of those present that the Council and the Engineering Section probably could make a most valuable contribution along this line by taking an active part in the formulation of safety codes for particular industries in which the National Safety Council has large membership and where a good deal of preliminary work already has been done, as the metal, mining and the paper and pulp industries.

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

VOLUME XXV. FEBRUARY 20, 1920 NUMBER 4

Principles of Gas Combustion

By PROF. O. L. KOWALKE,
Professor of Industrial Chemistry, University of Wisconsin.

Presented January 14, 1920.

THE series of experiments which I will discuss in this paper are some that were made in co-operation with the Wisconsin Gas Association. Two years ago some members of the association were very much interested in the relative efficiency of the ordinary Bunsen combustion as it is practiced in most gas-fired furnaces, and the so-called Surface Combustion. This seemed to be a problem that was worth while. We planned to determine, first, what temperatures can be attained in a furnace using a gas air mixture with the ordinary Bunsen combustion; and, second, what temperatures can be attained by using surface combustion; third, how much easier would it be to maintain a given temperature with the Bunsen combustion than with the so-called surface combustion. Other problems that seemed to be of interest were, how much oxidation will occur on steel when annealed in the furnace where the atmosphere is either oxidizing or reducing; how much of a structural change will occur in steel when heated to a fairly high temperature in a strong reducing atmosphere. These problems seemed to be of interest, in view of the fact that a great deal of gas is being used for the heat treatment of steel.

The facilities at our disposal consisted of a No. 5 gas furnace, Fig. I, made by the American Gas Furnace Company, of which Fig. II is a cross-section. The furnace was 15 inches wide, 12 inches high and 18 inches long from front to back. The gas inlet was a ¾-inch pipe and the air inlet a one-inch pipe. The muffle was removed from this furnace because it seemed desirable to simulate the conditions ordinarily found in a heat treating furnace where the products of combustion come in direct contact with the material that is being heated.

Fig. III shows the method employed by the Surface Combustion Company of New York. The gas ports are located on the sides and the flame impinges on a mass of coarse carborundum—quartz has also been used—and then is reflected to the ceiling, and back onto the articles located on a hearth in the middle. What we tried to do was to make an adaptation of the surface combustion principle to this furnace. The part labeled "quartz" in Fig. II was a clean quartz, sieved through a screen having a half inch square opening.

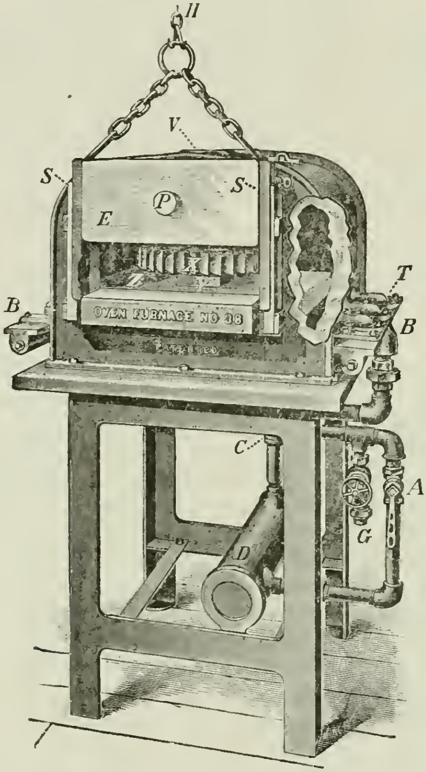


Fig. I

This was laid in the manner shown, to a depth of three inches, and the angle of slope approximately 35 degrees. Then a carborundum brick was set on end in the position shown by the word "brick," which was to serve as an object at which to look with the optical pyrometer to determine the temperatures.

Various mixers for gas and air were tried. That shown in Fig. IV is a rather crude affair. The nozzle for gas is a piece of tin which was soldered on to the pipe, the opening being a half inch. The gas and air entered in the manner shown. This was the mixer supplied with the furnace and will be known hereafter as the American Gas Furnace regular mixer.

Another type of mixer, Fig. V, was kindly loaned to us by the Eclipse Fuel & Engineering Company of Rockford, and here known

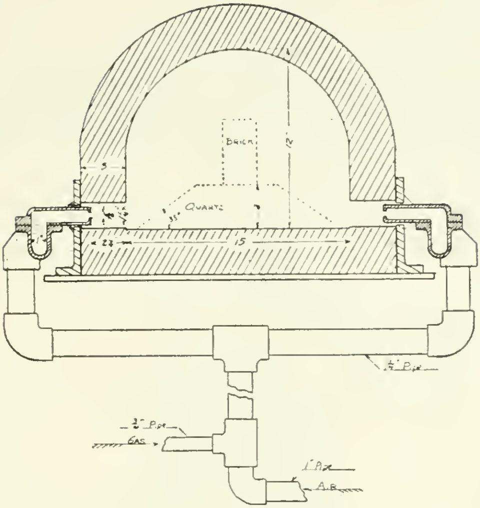


Fig. II

as the McKee Mixer. This device was very carefully constructed; it consists of a cast iron shell lined with lead, tapered in the manner shown. The gas, you notice, enters the throat of the mixer through a rather narrow opening about 3/16 of an inch. It so happened that in both cases the opening for the nozzle in the throat was ½ inch; so we had conditions which were quite comparable. This mixer is about 10⅞ inches long over all. The gas opening is 1¾ inches, but we bushed that down so that the supply pipe was still a ¾-inch pipe and the air pipe remained a one-inch

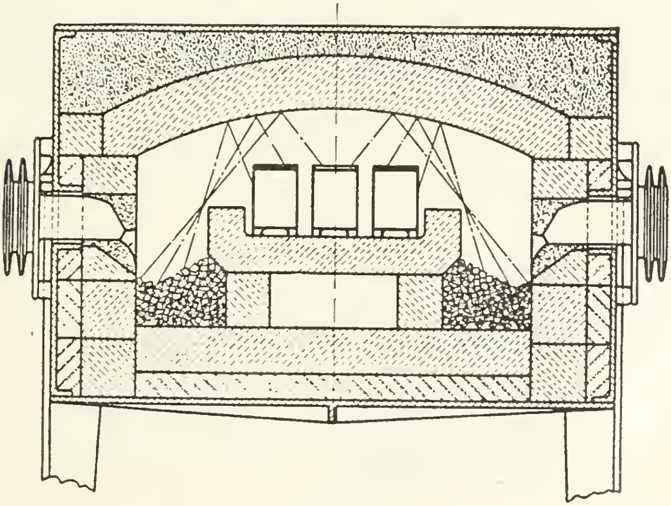
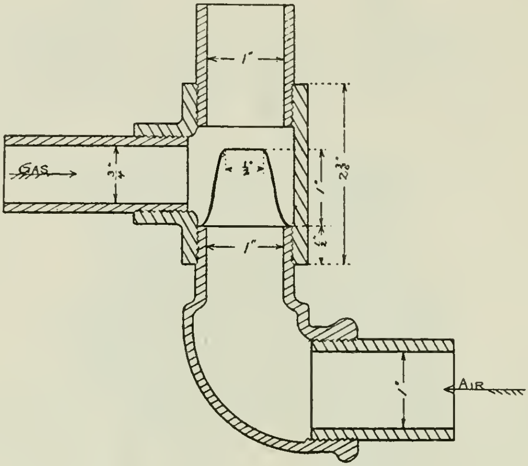


Fig. III

pipe. The delivery pipes for air and gas remained the same under all conditions.

Figure VI will show a mixer which is used by the Surface Combustion Company, but which was not available for these tests. I am showing it to illustrate the great care used by this company in the construction of the mixing device. It should be stated at this point that this company seems to have spent a great deal of money and brought to bear a great deal of engineering talent to very good advantage in working out the various problems. I don't want to be understood to be saying anything derogatory to this company nor to enter into any controversy. I am simply presenting certain experiments here for your consideration, and you can draw your own conclusions.



AMERICAN GAS FURNACE
REGULAR MIXER

Fig. IV

The combustion tests were carried on about as follows: The gas was under a pressure of from four to six inches of water column and the air was under a pressure of five inches of mercury,

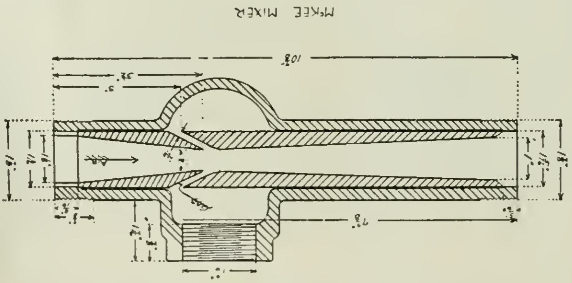


Fig. V

or about two and one-half pounds, supplied by a suitable blower. The gas was measured by a meter which supplied this particular project alone, so we had no interference from other projects in the building. The first test was to determine how high a temperature could be obtained in the furnace with gas at main pressure and an air blast about two pounds. We took this furnace shown in Fig. II, with the bed of quartz removed, and let the burners go full blast without attempting to regulate the air supply in any way. Our idea was to find out how high a temperature we could get under those conditions. After running the furnace for approximately three hours we obtained a maximum temperature of 1420 degrees Centigrade with a consumption of 950 to 990 cubic feet of gas. The gas was barburetted water gas supplied by the Madison Gas & Electric Company, average B. T. U. about 600. With the unregulated air it was difficult to get a high temperature in a short time with the ordinary Bunsen combustion.

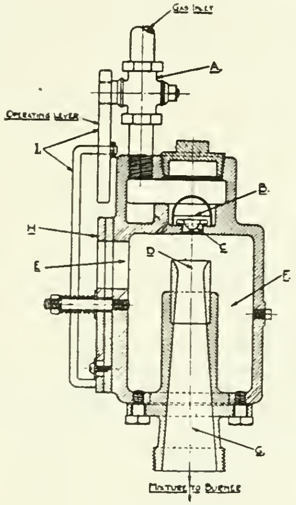


Fig. VI

By Bunsen combustion let us understand that process where a blast of air aspirates a supply of gas and then drives the mixture of air and gas to the mouth of the burner where it is ignited. Under surface combustion let us understand a Bunsen burner construction where the gas, under pressure, issues from an orifice and aspirates the right quantity of air so that the stream of gas drives the mixture of air and gas into the burner mouth, and then from the burner mouth the flame impinges on a surface such as coarse quartz or carborundum. Then the Bunsen mixer is one where the stream of air aspirates the necessary gas and the flame issues unrestricted in space. The adapted surface combustion is where high pressure air aspirates the required quantity of gas and then the flame impinges on a bed of incombustible or very highly refractory material.

In the innocence of our ignorance, for the first experiments, a very high grade fire brick was crushed to a suitable size and laid up in the manner shown in Fig. II. Of course the brick slagged down pretty readily. It did not hurt the furnace to any extent, but it formed a glassy surface over the incline surface of the crushed fire brick. The temperature obtainable under these conditions with an unregulated supply of air was 1420 degrees C. We tried covering this surface of the crushed fire brick with carborundum, but that didn't give any better results—we still got 1420 degrees, and used a considerable quantity of gas. The old fire brick backing was removed and the quartz substituted. Then, with the "regular" American Gas Furnace Company's mixer and the air carefully regulated so that there was no excess, a second series of experiments was tried. In this case, with an excess of oxygen of about .1 of one per cent on the average, and no carbon monoxide, in two hours and 36 minutes, with a gas consumption of 745 feet, we obtained a temperature of 1420 degrees C. You will recall in the first tests we used 950 cubic feet of gas with ordinary Bunsen combustion, no attempt being made to regulate the air supply. In the second case we obtained, in probably an hour less time and with approximately 200 cubic feet less gas consumption, the same temperature.

Then we tried regulating the air supply, using the Bunsen combustion, no quartz in the furnace, but substituting the McKee Mixer, that long venturi shaped affair. We also carefully regulated the air supply to about 0.1 per cent excess of oxygen. In this case in one hour and six minutes, using 975 cubic feet of gas, we obtained a maximum temperature of 1591 degrees C. Things were getting pretty hot and the fire clay lining was beginning to melt at the top of the furnace, to leak down like so much molasses, so the test was stopped. We next put in the quartz in the manner shown in Fig. II, and used the ordinary mixer supplied by the American Gas Furnace Company, and the temperature obtained was about 1420 degrees again. Then we put in the McKee Mixer, Fig. V, with the quartz, adapted surface combustion, and in an hour and fifty-six minutes, using 1,000 cubic feet of gas, we obtained a temperature of 1700 degress. The quartz in front of the orifices was fused to a transparent mass, and quartz, you know, has a fusing point of about 1750 degrees Centigrade. The temperature of the brick set up on top of the quartz was 1700 degrees. We had to quit because the furnace was getting pretty warm and molten fire clay was leaking rather badly from the roof.

It may be interesting to show Fig. VII, a comparison between the tests Nos. 5 and 9. Test No. 5 is a Bunsen combustion, using the McKee Mixer, and Test No. 9 is the adapted Surface Combustion, using the McKee Mixer. The upper curve, Test No. 9, shows the temperature obtained in slightly less than two hours; we reached 1700 degrees C. The lower curve is the log of gas consumption with the time. The dotted curve is the temperature obtained using the McKee Mixer with Bunsen combustion, Test No. 5. It will also be noted from the curve below that while the rate of gas consumption with Bunsen Combustion is higher in the first thirty minutes, we also got a very much higher temperature, which was to be expected; but where the rate of gas consumption is the same in both cases, notice also that rate of temperature rise is practically the same. Notice that in Test No. 5, when we reached 1591, the temperature was still rising rapidly, and there is no question in my mind that we could have reached 1700 degrees had we cared to; but it seemed desirable to save the furnace for some additional experiments. That old furnace is still doing business, and I expect it will continue to give us more service.

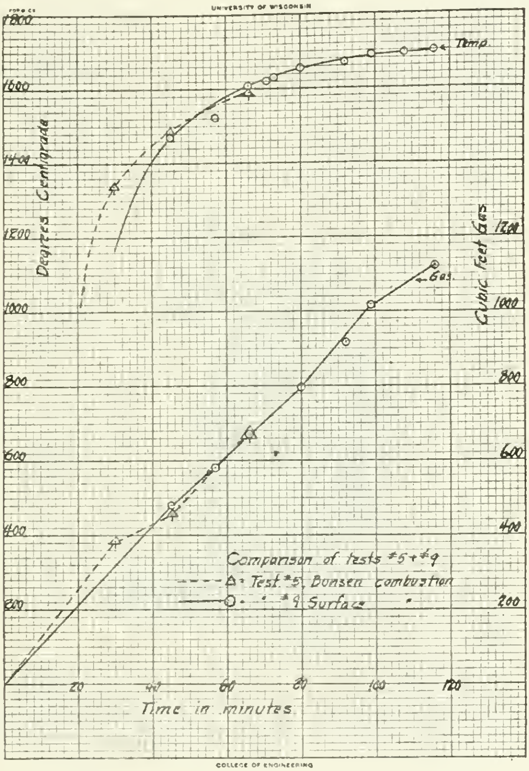


Fig. VII

So it seems from these experiments that the intimacy of mixtures of air and gas, with a careful regulation of the air supply, is a factor of very great importance. It would seem that proper mixing of gas and air will give the same results as impinging the gas on some sort of incandescent surface.

February 20, 1920

I will relate here an experience obtained a number of years ago with the combustion producer gas, analyzing about 145 B. T. U.'s per cubic foot, with a mixer which I was called upon to examine. We obtained a temperature of 1425 degrees Centigrade with the 145 B. T. U. producer gas made from hard coal, and it impressed me that the efficiency of mixing of air and gas is a tremendous factor in combustion.

That completes the experiments on how high a temperature may be attained with these different varieties of combustion and mixers.

The problem that is constantly before combustion engineers is: How much gas will it take to keep a furnace going after it is up to temperature? Will the ordinary Bunsen combustion be less efficient than the Surface combustion, or vice versa, or are they the same? A series of experiments was made in which the temperature of the furnace was raised to above 900 degrees, in order that an optical pyrometer of the Morse type, where the filament disappears against the field in view, could be used, so there was no uncertainty as to whether the thermo-couple had changed calibration in the meantime. The lamp used was one that had been carefully aged and it remained remarkably constant during the two or three months of experiments. The regular mixer furnished by the American Gas Furnace Company was first used, and with the ordinary Bunsen combustion we maintained for a period of an hour a temperature varying from 995 to 985 degrees Centigrade, and burned 109 cubic feet of gas. Then we put in the quartz as shown in Fig. II and had the flame impinge on it, simulating the Surface combustion type of furnace. We held a temperature in the furnace varying between 994 degrees and 988 degrees C. for an hour, and used 125 cubic feet of gas. There is then a difference of 16 cubic feet of gas with the two types of combustion, using this old style of mixer. (Fig. IV.)

Then the same tests were tried with the McKee Mixer (Fig. V), installed. The temperature in the first test was 883 degrees C. We had some trouble getting things just right that day, but the test continued for an hour and thirty minutes and we held the temperature practically constant at 883 degrees. There was one reading in this table before me of 880 degrees, every other reading for the hour and a half being 883 degrees. We used 105 cubic feet of gas per hour under those conditions, so there is about the same gas consumption as before.

Another type of mixer which we used, but which proved to be too small for the size of furnace that we had, was a proportional mixer, Fig. VIII, that was loaned by the Eclipse Fuel & Engineering Company. It did very well in the tests on gas consumption when the furnace was kept at 900 degrees C. This little device is probably familiar to all of you. It consists of a motor driving a fan in the larger casing and the air is drawn in at the point where the handle is located, just above the fan. We could not get over 1300 degrees Centigrade with this outfit, because it did not have the capacity. I presume on a smaller furnace where the radiation was not so great we might have obtained a higher temperature.

The appearance of the flame is rather interesting. Where there is no excess of air the flame is slightly yellow. Just as soon as a little carbon monoxide comes in the flame runs to a blue. One can tell, with a little experience on any one type of furnace, about what per cent of carbon monoxide is present in the products of combustion. It is possible to do this up to six or seven per cent—beyond that the flames get so big it is impossible to make an estimate.

Another question of interest to the combustion engineer is how much oxidation occurs on iron when heated in a furnace with water gas. We used specimens of 0.95 per cent carbon steel one-half inch diameter, and about two inches long, to a fairly smooth surface. A flat spot was filed on one side so we could always measure the diameter in the same place. The specimens were left in the furnace for varying periods of time, then removed from the furnace and quenched in water. When cold, the specimens were rubbed with fine emery cloth so that the oxide film was just removed, and then calipered with a pair of micrometer calipers. On heating the specimens in an atmosphere containing 19 per cent of carbon monoxide, for periods varying from 5 minutes to 15 minutes, at a temperature of 925 degrees, approximately, there was a loss of about .003 of an inch in diameter, which is very small. With one per cent of carbon monoxide the loss is about the same, with the same length of time and the temperature of heating. There is a slight increase in the loss with .4 of one per cent of oxygen; and with 1.3 per cent of oxygen there is probably twice the increase in oxidation, or, stated otherwise, the increase in the loss of diameter is about twice as much as it was with no free oxygen present.

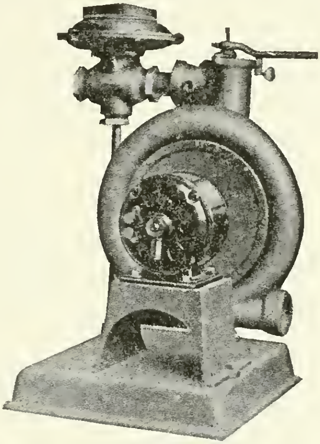


Fig. VIII

This test was made because of a question that was put to me by one of the men in the Wisconsin Gas Association who wanted to take on a certain kind of business. The customer was using a coke fire with good results, but with a gas fire he would get certain scale conditions that were not desirable. So it seemed worth while to look into this matter and to explain why it was that certain oxide conditions would arise even though a high percentage of carbon monoxide, which is a potent reducing agent, were present. Iron at a bright red heat will combine with the steam formed in the combustion to form the magnetic oxide of iron and hydrogen. It is similar to that experiment, which I suppose all of us have seen in our Freshmen chemistry, where steam is passed over red hot iron filings and hydrogen produced. The heat of formation of carbon dioxide from carbon monoxide is about that of the heat of formation of steam. Since steam is present in rather large quantities and there is no free oxygen, the oxidation of the iron proceeds in spite of the presence of carbon monoxide.

We found that with an atmosphere of carbon monoxide of about 4 per cent, with a .95 carbon steel, after a period of an hour and a half, the iron on the outside became very severely decarbonized so that it was practically a soft iron. The carbon monoxide here will act to take out that carbon.

DISCUSSION.

Mr. Clark: I would like to ask if any calculations have been made as to the amount of heat units that can be put in a cubic foot of element space per hour, and then compare the results with the other different kinds of fuel, such as producer gas or coke oven gas or water gas or fuel oil.

Prof. Kowalke: No, we have not, Mr. Clark, for the reason that in our laboratory we do not have a producer gas outfit, nor other kinds of fuel except city gas.

Question: You indicated that you are able to take a little of the carbon out of steel. Does that promise that some practical invention may be arrived at whereby you can get an appreciable quantity of the carbon out of the steel if you have too much in?

Prof. Kowalke: I should say it would be possible, but not practical. It would cost too much. You can do it cheaper other ways. I don't think it would penetrate very deeply; it would take out the carbon on the outside.

Question: Then the thought was more to decarbonize a thin sheet in spots and leave the tool hard in other places?

Prof. Kowalke: I think that might be done, but I have made no experiments.

Question: Where you burn with the least excess of oxygen do you get the best results finally?

Prof. Kowalke: In getting the high temperature or in maintaining a constant temperature you use the least amount of fuel with just the right amount of oxygen.

Question: Then that devolves itself back to the question of the most efficient mixer?

Prof. Kowalke: Yes.

Question: As to the oxidation of the material heated, the iron, the best results were obtained also when you had the least excess of oxygen, were they not?

Prof. Kowalke: Yes, really when we had a deficiency of oxygen.

Question: Have you worked on these gas furnaces working your combined fuel under high pressures to note what temperatures you get that way?

Prof. Kowalke: I did not do it in this series of tests, but we have done it under other tests and have reached to 1700 degrees Centigrade.

Question: There was a torch exploited on the market using a low pressure flame around a nozzle of high pressure flame from a heated gas mixture or a gasoline vapor mixture, and with that torch they can melt down cast iron very readily.

Prof. Kowalke: I would not call that a very high flame temperature. Cast iron will melt at about 1200 degrees.

Question: The whole nozzle is not larger than a silver dollar, with a series of outside perforations that will supply the ordinary air pressure mixture.

Prof Kowalke: You can melt cast iron in a crucible with the ordinary Bunsen burner, using a slight blast on it.

Question: Does not the operation of that come from the fact that the inner flame draws in the air to get a better mixture of the combination?

Member: Yes, that is the principle of it, only in this case the mixture was already made and compressed as a mixture.

Prof. Kowalke: The outer sheet would simply serve as a shield to prevent radiation.

Question: My first idea of Surface Combustion was that kind used in London with gas under high pressure that was mixed and passed through a porous brick of some kind and ignited on the outside. That is radically different from the process you described.

Prof. Kowalke: They had trouble there, as I understand it, due to the heat being conducted back through the porous diaphragm and igniting the mixture behind the diaphragm and getting a backfire.

Question: Is the temperature at which the air and the gas is introduced in the burner of any effect on the efficiency of the burners?

Prof. Kowalke: Broadly speaking, yes. As far as the efficiency of the furnace is concerned, it is a question of in-put and out-put. If you heat the air and the gas you are simply adding that much energy to the amount which the gas would give on combustion and could be made available to do useful work.

Functions and Work of the Resident Engineer On Bridge Construction

Dr. J. A. L. Waddell, M. W. S. E.,
Consulting Engineer.

THE following notes have lately been prepared by the author for the guidance of his field forces on future bridgework; and, in accordance with his long-established practice, he herewith presents them to his brother engineers in the hope that they may be found of service. It is true that in his book, "Bridge Engineering," he has treated this subject quite fully; but it will be found that these notes are more complete, thorough, and up-to-date than that treatment. In their preparation he was aided by his principal assistant field engineer, Mr. C. K. Allen, who has had a long and varied experience as resident engineer on the construction of large and important bridges, mainly in the author's employ.

Functions of the Resident Engineer.

The Resident Engineer is in direct charge of the actual work of construction; and on him the designers and the owners rely to ensure that most or all of the constituent materials for the construction, excepting the metalwork, comply fully with the requirements of the specifications as to quality, that the structure is built to the dimensions shown on the plans and in the exact position therein required, that the workmanship is first class, and that the materials awaiting use are so stored, handled, and cared for that they shall not be injured, wasted, or destroyed. On large jobs his work becomes mainly administrative, as he has a force of instrument men and inspectors under his direction who spend their time on the various parts of the work to which he details them, and who keep, and furnish to him daily, records of the work done during the day under their inspection, and of the number of men and the amount of plant employed on the work.

The Resident Engineer should be competent to take up the job of any one of these assistants or to instruct a new man in any of his duties. This requires that he be a master of surveying, conversant with the proper methods of inspecting all materials used in construction, and able, should occasion arise, to operate the contractor's plant. He should be familiar with the various methods of construction used in other structures similar to the one he is building. In all actions regarding the work he must not lose sight of the fact that he is a confidential agent, not a principal. His conduct toward all should be dignified but not overbearing. He should be ready to listen attentively to others who come to him in good faith making requests or suggestions regarding the construction, and he should not be hasty in rendering opinions. Having once delivered an opinion, he should be slow about reconsidering it. He should make acquaintance with the leading men of the community in which he is stationed, and should so conduct himself that he will acquire and retain their good will for himself and for those whom he represents.

The Resident Engineer should have full control of all the operations of construction at the site of the structure to be built. He personally should choose all his inspectors and assistants; and all payments to them for salaries and expenses should be made by him, he requiring them to furnish him with duplicate receipts for for all such payments. He should have full power to discharge any of his employees without recourse. All reports of inspectors on the work should be made directly to him; and he should be responsible to his superiors for the acts of all his subordinates.

He should make out all the progress reports required by the head office, and send them in at such intervals as stipulated. He should keep account of all constituent materials received on the job, showing quantity, date received, source of supply, when inspected, where stored, and amount of material used to date.

He should give all necessary lines and grades, defining them on the ground by stakes, hubs, bench marks, or other marks, to enable the contractor to build the structure in accordance with the plans and specifications. This, however, does not mean that he should waste his time with minor details, which can be obtained and marked out by a good mechanic from proper governing lines and points. As the work progresses, he must make the necessary measurements to enable him to determine that the structure conforms to the plans and specifications as to both dimensions and position.

He should issue or deliver all orders to the contractor regarding the work; and in case the main office should wish to transmit an order to the contractor, it should send the same to the Resident Engineer in duplicate. Immediately on receipt thereof he should acknowledge it, and transmit one copy to the contractor, accompanied by a letter of transmittal, a copy of which should be sent to the home office with his letter acknowledging the receipt of its order. These letters and all orders should be filed in an *order file*—not with the general correspondence. All plans and changes of plans, or proposed changes of plans, from either the contractor or the home office, should be handled in the same manner as orders.

The Resident Engineer's office should at all times contain a copy of every letter, order, voucher, plan, account, or bill for material or labor, also copies of all inspectors' reports and progress estimates made, issued, or received by the Resident Engineer. These should all be filed under their proper heads in correct order and so arranged that any one of them may be referred to quickly at any time.

A safe should be provided for the storing of the more important papers. In it should be kept the office files, order files, log-book, survey record, calculation book, and progress estimates, when such are not actually in use.

MAKING AND KEEPING RECORDS.

All important surveys should be copied from the field books into a survey record as soon as made, so as to insure at all times a correct record of surveys from which all points and lines of control could be retraced or relocated. The record of surveys should never be taken into the field. On small jobs this record may be kept in the book of calculations.

Loose-leaf books of standard letter size are very convenient for record books, especially for Unclassified Labor Accounts, Calculation Books, and Survey Record; but where they are used for records that might be called into a court of law, each page should be signed and dated by the person making it at the time he notes the item. Each page should have a heading or title which will show beyond any doubt just what is recorded thereon and the source of information. In making records it is extremely important that they be kept up to date at all times. It may seem frivolous to stop something else, get down the book, and make a small entry that, in all probability, will not be required for some time, if ever; but unless this is done, things will be omitted which may turn out to be important.

A great many of the Resident Engineer's duties are of a semi-judicial character, as he acts as a judge not only of materials but also of operations, and of whether these comply with the terms of the contract. All his acts may at any time come under the review or inspection of a court of law; and he should always keep this in mind when making decisions or compiling records. The latter should be full, concise, and so made as to be admissible as evidence in a suit at law.

INSTRUMENTS.

All instruments for surveying or for testing materials, when not in use, should be kept in their cases or boxes in the Resident Engineer's office; and he should not allow his assistants to permit transits or levels to remain set up near derricks or machinery where there is danger of their being struck by the said machinery or by teams—unless someone is left to guard them.

HUMAN NATURE.

One of the things which enter to the greatest extent in the building of all structures is but seldom mentioned, and its importance in the work is frequently overlooked by young engineers—and that is human nature. The man who considers this and strives to understand his fellow men and their points of view will have greater success than the man who fails to do so. The contractor, the client, the workmen, and the various other persons to be dealt with are all limited to a greater or less extent by their individual methods or habits of thought and word; and to deal with these different persons and work with them without causing friction requires tact and good judgment on the part of the Resident Engineer. The avoiding of friction, not the creating of it, is good engineering; hence the Resident Engineer should be courteous, should lend a willing ear to suggestions for improving workmanship, materials, or methods, or to complaints from the client or the contractor. Having heard them, he should make his decisions deliberately, and only after he feels sure that he is in possession of all the material facts in the case. In no event should he come to a decision in the heat of anger, but should refuse to talk further at the time, deciding later after having cooled off. This will frequently save trouble for all concerned.

The contract places rather arbitrary power in the hands of the Resident Engineer. This being so, it is very essential that he abuse not the power entrusted to him. On the other hand, he must not fail to act promptly in exercising the authority conferred on him, if it be necessary to do so in order to protect the interests of his client or those of his superiors. Frequently serious troubles and losses are caused by the lack of a little common sense on the part of the Resident Engineer.

INSTRUCTIONS TO RESIDENT ENGINEER.

Entering on the Work.

As soon as possible study the plans and read the specifications carefully, so as to obtain a good general view of all that is to be done. Visit the site of the work and familiarize yourself with general local conditions, and determine the location for the field office and the permanent address for incoming mail and express, immediately notifying the home office and others with whom you may have dealings.

Setting Out the Work.

As soon as you can do so, talk over the methods of construction with the contractor, so as to learn as far as possible what he will require in the way of reference marks and lines for the work, and how these may best be placed, so that at all times there will be sufficient reference points and lines not obstructed by plant or material.

Make a careful survey of the site and set out an ample number of hubs or monuments to enable the lines of control to be given accurately at all times; and determine the elevation of a number of bench marks for use throughout the work. Each line or point of control should be so marked on the ground that there will be at least two separate and accurate ways of restoring it from the monuments, should the hubs near it become destroyed. After this survey has been made and thoroughly checked, the contractor should be furnished with a list and description of the reference points; and he should be requested to have his men protect them as much as possible during the progress of the construction.

INSPECTION OF MATERIALS.

Find out from the contractor what provision he has made or purposes making for the storing of materials, where he is obtaining materials, and whether he desires them inspected at the place of purchase or at the site of the work. If the inspection is to be made away from the site, the home office may elect to take charge of it, sending copies of reports on inspection to the Resident Engineer. Cement, sand, stone, timber, paint, paving materials, etc.. are generally inspected by the Resident Engineer after they are received; but structural steel, machinery, etc., are generally inspected at the shops by inspectors reporting directly to the home office. Wherever material is to be inspected, it is very important that it be well understood in advance as to who is to be responsible for the inspection; and no one else should presume to accept or reject material for the job, excepting only that, in case any faulty material has been passed by an inspector, delivered on the work, and later discovered by the Resident Engineer, the fact that it had already been accepted should not prevent him from condemning the said faulty material and having it removed, or at least from refusing to allow it to be used until he has been instructed to do so by his superiors.

VALUATION OF CONTRACTOR'S PLANT.

It frequently becomes necessary for the Resident Engineer to make out an estimate as to the value of the plant in use by the contractor. In order to do this intelligently, he should obtain the current prices of all pumps, engines, electric generators, boring machines, air compressors, boilers, derricks, concrete mixers, barges, pile drivers, etc., used on the work. A great many of these will be second-hand equipment. The cost of barges, such as are built and used on construction work, vary about as the volumes computed from the over-all dimensions; and many kinds of machines vary in cost for different sizes of the same type approximately as their weights. The records should contain a list of all the mechanical equipment on hand at the beginning of the work, and, as additional equipment is acquired or withdrawn, this record should be corrected, showing for each piece the date on which it was received or removed and the kind and size of machine. Whenever there is a breakdown of any part of the plant, causing a delay in work, there should be an entry made in the log-book showing what happened and the length of the delay.

STORING MATERIALS.

Materials which enter into the finished structure are generally paid for by the client in the first progress estimate made after they are delivered at the work, inspected, and accepted by the Resident Engineer. It is the duty of the contractor to store this material and keep it in good condition until used in the construction; and the Resident Engineer should not allow payment to be made for any material until after it has been delivered on the ground, properly stored, and satisfactorily protected against loss or damage. When a large amount of combustible material is to be stored, either it should be insured or else provision should be made for extinguishing a fire quickly, in case one starts. The falsework and forms for large concrete bridges are sometimes insured against loss by fire.

All steel and iron should be piled on wooden sills which are substantial enough to hold it clear of the ground; and, in case it is necessary to pile structural material more than one tier deep, the tiers should be separated by ample wood-blocking between them. All pieces that otherwise might be overturned should be well braced.

Serious damage is easily done to structural steel and reinforcing bars through carelessness in handling, hence one should see that in unloading metal the men do not injure it by dropping it or by picking up long slender members with a hitch at a single point near the center. When necessary, a double hitch should be used for picking up slim members, clamping a piece of timber against each one of them to hold it straight.

Wooden paving blocks should be ricked up in compact piles and covered so as to prevent checking; and, as all creosoted timber is very inflammable, it is necessary to see that the men are not allowed to increase the fire risk around the storage piles by dropping rubbish, old rags, lunch papers, or any material easily ignited by a spark.

Cement must be well protected by a good, tight cement-house; and the cement must be kept therein until required for use. Any cement that is condemned should be immediately removed from the cement-house or the vicinity of the concrete plant; and, as soon as the contractor can arrange to do so, it should also be removed from the job.

EXPLOSIVES.

In rock excavation and pier sinking, blasting powder or dynamite is employed at times in large quantities; and it frequently happens that the persons using it have a very limited understanding of the relative intensities of the effects of various explosives, especially when fired under water. Though it may not be generally conceded by contractors and quarrymen, it is nevertheless true that the intensity of a charge of blasting powder may be greatly increased by detonation instead of by lighting it with a fuse.

It is frequently necessary to use explosives in or under cribs or caissons during the sinking. If properly handled, the crib or caisson need not be injured; but, unless the work is done by experienced men, great damage is likely to result.

Resident Engineers should study the physical properties and nature of the various explosives in common use, so as to be able to determine the proper charge to employ in order to obtain a given result—also the probable effect of the said charge on nearby objects. Of course the problem is not capable of an exact solution; but the common custom of making a wild guess as to the quantity of explosive that should be used in a charge is entirely wrong.

The Resident Engineer should see that all local and federal laws and ordinances regarding storage and use of explosives are complied with by the contractor. Under no condition should the men be allowed to warm dynamite at an open fire. A safe method is to place it in warm water for a short while just before it is required for use; and the vessel used should be cleansed from all adhering explosive so as to avoid the possibility of accidents.

It is necessary to have the exploders kept away from the explosives in a safe, dry place. Nitro glycerine and dynamite freeze at 42 degrees F., and when frozen are comparatively inert and do not explode properly. When heated to about 80 or 90 degrees F., they become much more sensitive to shock; and, if sweating occurs, the cartridges are extremely dangerous to handle. In making a place for storing explosives, one should select a well-drained spot at a reasonable distance from the work, and should construct there a strong wooden box or a small house with substantial lock and key. The box or house should be well banked on all sides with earth, and a light covering thereof should be placed over the top. The idea in doing this is that, in case of an explosion, the material will be blown into small fragments and hurled into the air—not driven laterally by the blast. All explosives should be kept away from the blacksmith's shop.

FALSEWORK AND FORMS

In accepting forms and falsework now-a-days, the engineer or inspector must take into consideration the great change that has taken place in the quality of timber now available, compared with that of a few years ago. Such a thing as real long-leaf yellow-pine is but rarely seen, while lumber yards all over the country are selling so-called "yellow pine," which is of the short-leaf or lob-lolly variety, and not nearly as strong as the long-leaf pine that was in such common use a few years ago. Real long-leaf pine is very uniform in strength, while the short-leaf varies widely. This is especially true as regards crushing across the grain, some of the close-grained sticks being as strong as long-leaf pine, while the coarse-grained ones are very weak, especially when wet. Nearly all of the tables in common use for the strength of timbers were figured for much better material than is now ordinarily employed for temporary structures; consequently, if used without a proper factor of safety, they give results which are too high.

In concrete forms the greatest stress comes on the timber when it is wet, and this further reduces its strength. A little more attention to this condition would avoid many of the unsightly bulges and offsets which occur in concrete surfaces due to the yielding of forms.

As timber is but seldom employed in trusses for permanent structures these days, the young engineer is almost sure to be without knowledge as to the relative advantages of the various methods of framing the joints of timber trusses; and, as it frequently becomes necessary to introduce wooden trusses into falseworks, he should familiarize himself with good practice in their construction.

CAISSONS

In building pneumatic caissons the general tendency is to neglect small details in framing and caulking, which results in numerous leakages of air, each small in itself but in the aggregate amounting to serious proportions. This costs heavily in coal consumption and in machinery required. All joints of the timber in a caisson below the top of the deck courses should be especially well fitted and secured, as the creeping or twisting of a single stick will produce leaks. All struts or shoes in the working chamber should have their entire ends in full bearing; and ample metal or hard wood corbels should be employed in order to prevent side-crushing on timbers. All bolts which enter the chamber should be wrapped with a piece of oakum under the washer and drawn so tight with long wrenches that a large initial tension is placed in the metal. No timber or sheeting-plank which will show in the chamber should be laid before it is out-gauged for caulking around all edges that will be exposed.

In spiking, holes must be bored through the sheeting for all spikes, and these must be driven until their heads are projecting about one inch. Then each and every spike must be wrapped with a thread of oakum and driven in hard.

All cracks or checks found in the sheeting planks or on the faces or ends of inside timbers must be caulked with a thread of oakum or candle-wicking. All joints between sheeting planes or timbers must be caulked, hossed, and then caulked again, after which the caulking should be painted with red lead. While such is not generally the custom, the ends of timbers should be coated with pitch to prevent the passage of air through the grain of the sticks; for, unless this is done, a much larger amount of air will be lost than is commonly supposed. Where pitch is used on timber, it should be prepared by adding tallow to it when boiling, in order to render it tougher, as is done in shipwork.

After all the caulking is finished, it is an excellent plan to whitewash the roof and sides of the working chamber, as it improves the illumination very materially and thereby assists the sandhogs in their work.

One should see that all roof plates for main shafts, material shafts, pipe lines, and conduits for electric lighting are not only made with air-tight joints to roof, but also that the connections to roof are so strong that they will not become broken or loose during the sinking.

CRIBS

When sheeting is employed on the outside of the cribs, the inspectors must be alert to ensure that the marks on timbers that show the height above the cutting edge do not become covered by the sheeting before they have been transferred to timbers above. A good plan is to mark the height on each second course, as soon as that course is pinned down, by a small brass nail driven in the timber; and, when the sheeting is placed at the corners, transfer the reference points to the outside of the sheeting, then with a chisel cut a clean notch in the sheeting and make an identification mark. These marks must be carried up at the four corners of a rectangular crib, and on octagonal cribs at the ends of two diameters taken at right angles to each other. As a tall crib requires a number of short measurements to be made at various times, especial care must be exercised, or else the measurements will become lost or an accumulation of errors will be introduced. The distances from the cutting edge to the top of the timbers of each course, measured at the corners, should be kept equal; and in case any course is found to be gaining on one side or corner, the top should be adzed down.

PILE FOUNDATIONS

When piles are to be driven in cribs, the material inside thereof should be excavated considerably below the proposed elevation for the bottom of concrete, as, in driving the piles in clay or plastic earth, the action of driving will raise the material between them. Clay and gumbo are hard to remove from between heads of piles that are closely driven. When the material is sand and the piles are to be put down with a jet, the action of driving will leave the sand several feet higher than it was before driving. It is sometimes much easier to excavate the sand to a sub-elevation, estimated as enough to take care of this increase, than it is to clean out between the pile heads with a sand pump after the piles are driven. Even then there is almost certain to be a quantity of sand which will have to be removed before concreting.

SEALING

After the entire bottom has been cleaned out, ready for sealing, and just before sealing is started, the Resident Engineer should make measurements, well distributed over the entire bottom of the crib, in order to determine the elevation of the bottom of the base to the nearest 1/10 of a foot at each point. These measurements will be needed in calculating the final quantities.

The only method that should be allowed in placing the concrete sealing-course around the pile heads is that by trémie. The pipe thereof should be from 10 inches to 12 inches in diameter, and the hopper at top should be large enough to hold a complete batch of concrete as it comes from the mixer. To put the trémie in operation, hang it from the boom of a derrick in such a manner that it may be raised or lowered quickly, let its lower end just touch the bottom of the excavation, and fill the pipe with very rich concrete as fast as it can be poured. Fill the hopper also, then raise the trémie just enough to start the concrete flowing, immediately lowering it again so as not to lose the charge below the surface of the water. Keep the concrete flowing through the trémie as steadily as you can, being careful not to let it run out, so that the pipe will not fill with water. The first batch started as above may be badly washed, but as the stone will be heaped up in a ring around the trémie, the following concrete as it comes down will roll it into the first concrete; and, if the work is properly done, there will be no gravel pockets, and the quality of the concrete will be excellent. In case it is desired to prevent the washing of the first batch, a wad of straw or excelsior, packed rather loosely in a cement sack, may be placed in the trémie pipe immediately ahead of the concrete; then, if the pouring is done properly, the concrete will act like a solid piston and push the water ahead of it. Great care should be exercised to prevent concrete from ever hardening in a trémie.

In open cribs where piles are not required, bottom-dump buckets may be used, but they must be so constructed that they cannot be opened, after starting to lower them, unless they reach the bottom. If double-line buckets are employed, the lines must be so arranged that the buckets will not spin and twist the two lines together. The inspector should watch the lowering carefully, where double-line buckets are used, to see that the load is not gradually shifted from one line to the other before the bucket reaches the bottom, thus dumping the concrete through the water. While, if properly handled, concrete can be transported through many feet of water and deposited without injury, if it is dropped loose through but a shallow pool, it will be badly washed and the cement will be removed. Concrete must not be cast into water under any circumstances. The bucket should be set on the bottom gently, so as not to wash the top of the concrete already placed, and then lifted by the trip line very slowly for the first three feet, after which the rise may be rapid. In comparatively warm water the concrete will be hard enough in 72 hours to pump out properly-sealed cribs of moderate depth so as to clean the scum off the top of the concrete, saw off the piles, etc., and then build the pier in the dry.

The bottom-trigger device on a dump bucket is a good, foolproof means of making sure that the bottom doors are opened at the right instant, as the trigger is worked automatically when coming into contact with the solid material at the bottom; and the dumping, therefore, does not depend upon the personal equation of a workman handling a trip line. Upon one occasion a comparative test was made of concrete deposited by means of the trigger device and that placed by the use of the trip line, the result being decidedly favorable to the product of the former method.

SURVEYS

The Resident Engineer will receive from the main office a general-layout drawing in which the main controlling points and the distances between them are clearly indicated on a profile and a plan. It remains for the Resident Engineer to set a series of hubs or other monuments that will locate on the ground at least the more important lines and distances shown on the plat. These reference points should be set with a view to their accessibility during the entire period of construction—a point frequently overlooked by the inexperienced Resident Engineer.

Where one or both banks are of an elevation as high as the deck of the new structure, so that an observer can see over the tops of all piers, a large part of the instrument work can frequently be done directly from the center line of the bridge, which is the best condition; but where the shores are low, as soon as piers are built they obstruct the view, hence recourse must be had to offset-lines and triangles for both position and alignment of the piers. In any event there should be laid out in advance at least two independent methods of checking the position and the alignment of all piers, because one method may be blocked at any time by the necessary movements and uses of the contractor's plant, or by storage of materials, etc.

Where the crossing is long enough to require triangulation, consideration should always be given to the prevailing direction of the wind and its effect on the smoke from the engines and boilers in use around the work. The direction from which the best unobstructed view of the crossing can be obtained should be selected for the observations necessary to the checking of position during the construction. While it is very desirable that the base line should end at or pass through the main points of triangulation, it is not really essential; and frequently time can be saved and accuracy of measurements increased by locating the base line where it may be washed out by the first high water. Where the conditions for the length of time necessary to make the triangulation are excellent for accurate work (for instance, along the Missouri River at ordinary water), there are frequently long, high-and-dry sand bars, which are firm, and on which long base lines can be quickly and accurately located; and then the distances between points on shore can be determined with great precision, and the web of triangulation stations may be extended indefinitely.

The sketch shown in Fig. 1 is from an actual survey for a crossing of the Missouri River, Point A being in thick willows and cottonwood timber, and Point B on a high bank where buildings, timbers, etc., were in the way of direct base-line measurements. There was a small slough of water near the bank at A, but a high sand bar made the accurate measurement of the base DCE a simple matter. DE was 750 ft. long, and DC 350 ft.; and the points D, C, E were set in the same line, C being at the intersection of the lines AB and DE. The base was measured four times with a 50-ft. tape, supported at 25-ft. intervals, and pulled to a uniform tension; and a glass thermometer tied along the tape was read at each measurement. Each of the points A, B, C, D, and E was marked by a small indentation made with a center punch in the head of a copper nail driven in the top of a large hub. The three angles at each of the points A, B, D, and E, and the four at C were then measured by repetitions both to the right and to the left, and the sum of all the angles (both interior and exterior) at each of the four exterior points gave for each point an angle which varied from 360 degrees by a small quantity—never in excess of 10 seconds. This amount was then logically divided among all the angles at the point; and after the various angles had been thus corrected, the angles in each triangle were adjusted to make their sum 180 degrees. The triangles ADE, DEB, ACE, BCE, ACD, and BCD were solved, and then the several separate determinations of the length of AB were compared. The distance was found to be about 1400 feet; and the greatest difference in the lengths of the three separate determinations was 11/64 of an inch. This work was done with a high-grade engineers' transit having a 6¼-inch plate divided to minutes; and the observations were made on a slightly-cloudy day. Targets were used on A and B, a pencil point serving as a flag on points D, C, and E. The entire field work was completed in two days by three men; and it will serve to give an idea as to what may be considered good work in respect to speed and accuracy combined. Had the weather not been favorable for observations, the time and the number of observations required would have had to be increased in order to obtain such good results. The probable variation from the true length in the mean length of the three determinations is about ⅛ of an inch. Points A and B were carefully referenced back onto the banks, and the distance between them was used as a base for extending a triangulation system for a survey up and down the river.

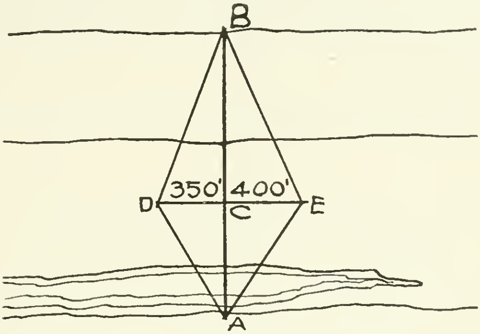


FIG. 1

The determination of distances and angles with great accuracy in bridge surveys requires that close attention should be given to the important matters of setting the instrument exactly over the point occupied, and having the line of collimation directed exactly through the points to which the angles are to be measured; i. e., errors of eccentricity and phase are to be avoided.

A slight but uniform air current may deflect the plumb-bob so that, even though the observer has used care in his set-up, he may be ⅛ of an inch or more eccentric to the true point; and this error may be increased several times in the distances sought, and thus cause material errors in angles. By use of the following precautions the instrument may always be centered over the point with great accuracy.

In Fig. 2 let the triangulation point be A, and let B and C be two hubs with sharp, well-defined points on their tops in the same vertical plane as A. Let D and E be two more similar points in a second vertical plane through the point A, making a good intersection with the plane through BC, i. e., as near 90 degrees as convenient. The distances of the points from A should not be too great —generally from 25 to 50 feet. Set up on A by use of plumb-bob, then with instrument carefully leveled sight on B, clamp, plunge the telescope, and sight on C. If the transit is in adjustment and exactly over the point A, the cross hair should bisect C; but if it does not do so, the instrument should be shifted a small amount on the adjustable head, and the test tried again. When adjusted in one plane, unclamp and turn to point D, clamp, plunge, and try point E, in the same manner as was done at C. In shifting the head a small amount, it will be found advantageous to take a soft lead pencil and mark the inside of the hole in the shifting head on the sliding plate underneath before loosening the head to move it. This gives a definite mark to gauge the movement. After a few trials one can make this test for position in a very few minutes; and, if close work is required, the time involved is well spent. One second of arc for a radius of one mile amounts to about ⅜ of an inch; and for a radius of 1000 feet it is .006 of a foot.

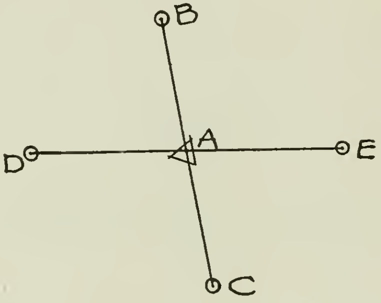


FIG. 2

In ordinary survey work the round or octagonal poles in common use are excellent tools and serve their purpose well, but when it is desired to determine angles in a triangulation system to the nearest 5 seconds of arc, when the lengths of the sides of the triangles are approximately 1000 feet, the use of such a pole, when perfectly centered over the point and truly vertical and steady, may cause an error of 7 seconds in the angle read, on account of phase. On long shots the vertical wire may cover the entire image of the flag pole, which would render accurate pointing difficult. These troubles are easily avoided by the use of fixed targets, which present a plane surface to the telescope, thus avoiding phase, and which have a white space in the center to be sighted to of such a width that the cross hair will appear as a black line with a clear white line on each side.

For targets to be viewed at a distance of 1000 feet, the said white field in center should be about ⅜ inch wide.

For measurements of length the steel tape should be employed, the use of rods or bars on bridge baselines being long out of date; and unless the expensive and complicated ice-bar apparatus, as developed by the U. S. Coast Survey, is adopted, the modern steel tape, when properly manipulated, will give more accurate results than rods or bars. There is a new steel tape (called the Invar) now available, in which the coefficient of expansion is very small, being 1/25 that of an ordinary steel tape. The use of one of these would be quite an advantage in measuring base lines, as the hardest thing to ascertain in such work is the actual mean temperature of the tape at the time of the measurement. With the use of the Invar tape, the difference becomes so small that an error of several degrees in the mean temperature would not be appreciable in the length of an ordinary bridge. As yet these tapes are very expensive, hence, not in common use.

The tape should be supported at intervals of about 20 or 25 feet, there being no material advantage gained by the adoption of closer supports. These supports should be spaced at equal intervals, as nearly as may be, so as to facilitate the computations in correcting for sag and for inclination of the tape. For effect of sag and the computation of length between end supports see Johnson's Surveying. Before measuring a base line one should determine the true length of the tape by comparison with other well-determined standards. This should be done by the contractor for the superstructure, he furnishing for the field work a tape which has already been compared with the one that will be used in measurements for fabrication in the shops. The U. S. Government will make comparisons and furnish a certificate of the true length of any steel tape for a nominal fee.

The determination of the horizontal projection of a distance measured with an inclination of not to exceed 18 feet in 100 feet is best made by the formula $L_1 = L - \frac{h^2}{2L}$, where L = the distance measured between supports, L_1 = the true horizontal projection of L, and h = the difference in elevation of the two ends of L. Where L is repeated several times with uniform length, the corrected value for $\lesssim L$ becomes $\lesssim L_1 = \lesssim L - \lesssim \frac{h^2}{2L}$. This calculation can ordinarily be made by slide rule with sufficient accuracy.

Extremely long tapes are a nuisance; and a 100-foot one is long enough for all ordinary base-line work. A very narrow tape is best for accuracy, as the effect of the wind on a tape increases rapidly with its width. There is no necessity for tapes to be fully graduated.

As the determination of the length of base depends on the correctness of several different tape-lengths, it becomes extremely important that, each time the tape is used, its end graduation be transferred to the top of reference hub with accuracy, the measuring to head of a tack or nail not being sufficiently exact. The marking of ends should be made on soft-metal plates nailed to tops of hubs; and the marking should be done with a sharp steel scribe. The exact line of base should be scribed on the plates before making the precise tape measurements. Base lines should be measured at least four times—an equal number of times in each direction; and the front and the rear chainmen should change places each time the base is measured. The final lengths as determined from each one of four measurements should not vary from the arithmetical mean of all the measurements by a distance exceeding $\frac{1}{200,000}$ of the total length.

Having completed the main base-line, a second one should be measured, *preferably* on the opposite side of the river and on the other side of the bridge, and so situated that its ends can be easily connected with the main triangulation and its length computed from the first measured base, thus giving a check on the accuracy of the entire work. This test should always be applied, but the second base need not be long. If there be good reason therefor, it can be located on the same side of bridge or river as the first base line. In any event there should be a line of known length to close on and check the accuracy of the entire work.

After the base lines have been established and monumented, the engineer should proceed to make an accurate survey in order to determine the distances between well-located monuments set back on the bank out of the way of all operations of construction. Next he should calculate the position of each pier or foundation in reference to these monuments, then make a scale drawing showing the bridge, the shore lines, and the centers of piers; and on this indicate the best location for additional monuments that will give good intersections for finding the pier centers. There should always be three lines for intersection in order to locate any pier point. Monuments should be set for all of these lines, so that in locating a pier the transits may be used as direction instruments only, i. e., merely to project a line from or between two well-established points. In accurate work, using high-grade engineers' transits graduated to 1 minute only, three lines thus intersecting over a pier should form a small triangle, the greatest length of any side of which for a bridge-crossing 1000 feet long should not exceed ⅜ of an inch; and the center of the triangle of intersection should be taken as the point.

Angles are to be measured by the method of repeating; and all angles meeting at a point, including the large exterior angle, should be measured and their sum taken from 360 degrees. This check will show a small error, which should be distributed properly among the angles at that point. After all the angles have been measured and adjusted to their probable values around the point, a second adjustment should be made so that the sum of the interior angles of each triangle of the system will equal 180 degrees. If the measurements and adjustment at the points have been carefully done, this last correction will be very small. Calculations are then to be made to determine the lengths of all lines joining the various points of the system. For methods of base line measurements and the manipulation of the instrument in triangulation work, also for the adjustment of values found, see Johnson's Surveying and Gillespie's Advanced Surveying, where the proper methods to pursue are set forth in detail.

MONUMENTS

The setting of the monuments which are to be used for reference throughout the work is a very important operation, and should demand the close attention of the engineer to ensure that they are correctly placed, are of ample size and durability to outlast the field work, and are so built or located that they will not be likely to settle or move during the time they are needed. But as the only way to be sure that a monument has not moved is to check its position, relative to other monuments, each monument should be well referenced by at least three other points so placed that even a very small movement in one of them can be easily detected. Where the work does not justify the setting of concrete monuments, very good results can be obtained by the following method: Use a four-inch post auger to drill into the ground at least three feet at the point where it is desired to set a hub. This can be quickly done in ordinary soils. Then drive a 4 inch x 4 inch piece of timber into the hole with its top flush with the surface of the ground, then with a spade dig out a cone-shaped hole around the top of hub to about one foot deep and refill this hole with cinders or gravel. A hub set as above will not be disturbed by the freezing of the ground; and, if protected from being struck by wheels or heavy objects, it will retain its position indefinitely. Moreover, it makes a fairly good temporary bench mark. For recording the exact point on the top, a good method is to nail a small plate of copper or zinc on the head of the stake or hub, and then mark the exact point with sharp lines scratched in the plate with a steel scribe, or by a small hole made with a center punch. A copper nail driven in the hub, and the exact point struck thereon with the punch also makes an excellent mark. Strong posts should be set around important instrument-stations to prevent disturbance and the piling of materials on hub. In setting triangulation stations, the elevations of the tops of hubs should be carefully determined when running the levels, in order to provide bench marks to be used for the control of building operations. These should be recorded where they may be quickly referred to, then each one of these hubs becomes a T. B. M. (Temporary Bench Mark) and may be used for the levels of construction. They should be checked from time to time for possible settlement.

LEVELING

In determining the elevation of bench marks, several completely-closed circuits should be run over the benches, one half to the right or clock-wise and the others in the opposite direction; and the mean elevations thus determined should be used as the true elevations. In case the work extends over a comparatively large area, in determining the most probable height of bench marks, the adjustment of the observed heights may be made by the method of least squares; but where the work has been carefully done, this refinement will be found to give results differing very little from those wherein the arithmetical mean of several well-made measurements is used for the true value.

One of the most difficult things that an engineer is ever called upon to do with a level is to make a crossing of a wide river with an accurate line of levels; nevertheless, it can be done. The main source of error in such work is the great difference in the refractions of the line of sight over the land and over the water. This is especially true near the middle of the day when the sun is shining, hence no river should be levelled over under such conditions. When the river is a thousand feet or more across, two levels and two rods should be used simultaneously, one rod and one instrument on each side of the river, the rods being held on the same points for both instruments. One should work carefully but rapidly; then, just as quickly as it can be done, the two survey parties should cross the river and repeat the observations. This method tends to correct all but the personal errors of the observers and is a check on them. In case several sets as above are to be made, it would be well to have the survey parties exchange the instruments for half the observations.

In setting shoes and machinery tracks of swing spans, etc., the greatest care should be taken to obtain the closest results of which the level and rod are capable; but in measuring excavations and ground surfaces, the nearest tenth of a foot is sufficient, and in setting forms for concrete work in the majority of cases 1/100 of a foot is close enough. In such lines as hand-rails, curbs, etc., a change of 1/100 of a foot, if it occurs in a comparatively short distance, may be detected by the eye, and hence more careful work is required therein. The general public will notice and detect a small error in either grade or alignment in a hand-rail or curb and will criticize the work adversely, while comparatively large errors in other parts of the structure will never be noticed by them. A large portion of the Bridge Engineer's work is the building of public bridges; hence, he should be careful to obtain straight rails and curbs, as the whole work will be judged by the appearance of these. He should do this without relaxing in the least his efforts to make the rest of the structure first-class in every respect.

Erecting Metal

Where high steel towers for vertical lift bridges are to be built, an extra telescope on the transit for vertical sighting will be found very useful in plumbing the steel work, and in setting out alignment for sheaves, etc.

In setting camber blocks for supporting steelwork during construction, and in placing forms and arch centers for concrete structures, allowance should be made for the compression of wedges and blocking and of all framed joints that bring the surfaces into closer contact. This compression will seldom be less than 1/32 of an inch per joint, and frequently as much as 1/16 of an inch with the kind of carpenter work obtainable. Also, where the piles or bents are tall and heavily loaded, there will be a material shortening of the piles or posts due to loading. It is always easier to lower with properly made wedges than it is to raise by driving them; also in erecting steel work, if the camber blocks are a trifle high, it makes it easier to set the sections of the top chord. As the camber set will be continually decreasing as the load increases, by the time the trusses are in place the ends of top chord sections will be in full bearing, as they should be.

The center line of bridge or the center lines of chords should be marked on the top of the falsework; and it is essential to see that the erectors put the steel into perfect alignment as the work progresses. This will require the testing of points about once a day, so as to determine whether there is any movement taking place in the falsework. Should any part of it show settlement or curving, additional supports or braces should be put in at once.

Staking Out Substructure

In staking out abutments, shore piers, pedestals, and retaining walls, the center lines of shoes or bearings and those of the trusses, girders, or arches which they are to support are considered as main controlling lines; and they will be required until the superstructure is in place. These lines, wherever possible, should be well located on the ground; and in checking excavations, building forms, etc., it is best to project them over the top and then check from them. In case these lines cannot be used and it becomes necessary to employ offset lines, one should take care in checking distances to and from these lines, and should be sure that the Foreman and the Superintendent understand just what secondary lines are given and their relative positions to the true reference lines shown on the drawings. The exercise of a little patience and trouble in explaining the lines and grades to the various foremen before they start to use them will save much difficulty later on.

Pier Sining

In "Bridge Engineering," page 1473, there is given a method of locating the bottom of a crib or caisson from the points observed on the top and making report of position to the contractor. The Resident Engineer and the instrument men should study this carefully and be sure they understand it before attempting to give position. In connection with that treatment of the problem, the following criticism is offered: On page 1475 in the standard reports the position of a pier is referred to the cardinal points of the compass. It has been found better to refer to up and down stream, right bank and left bank, where there is any flow to the water. The report form shown on page 1492 of "Bridge Engineering" does this.

Where piers have to be located by triangulation, it will rarely

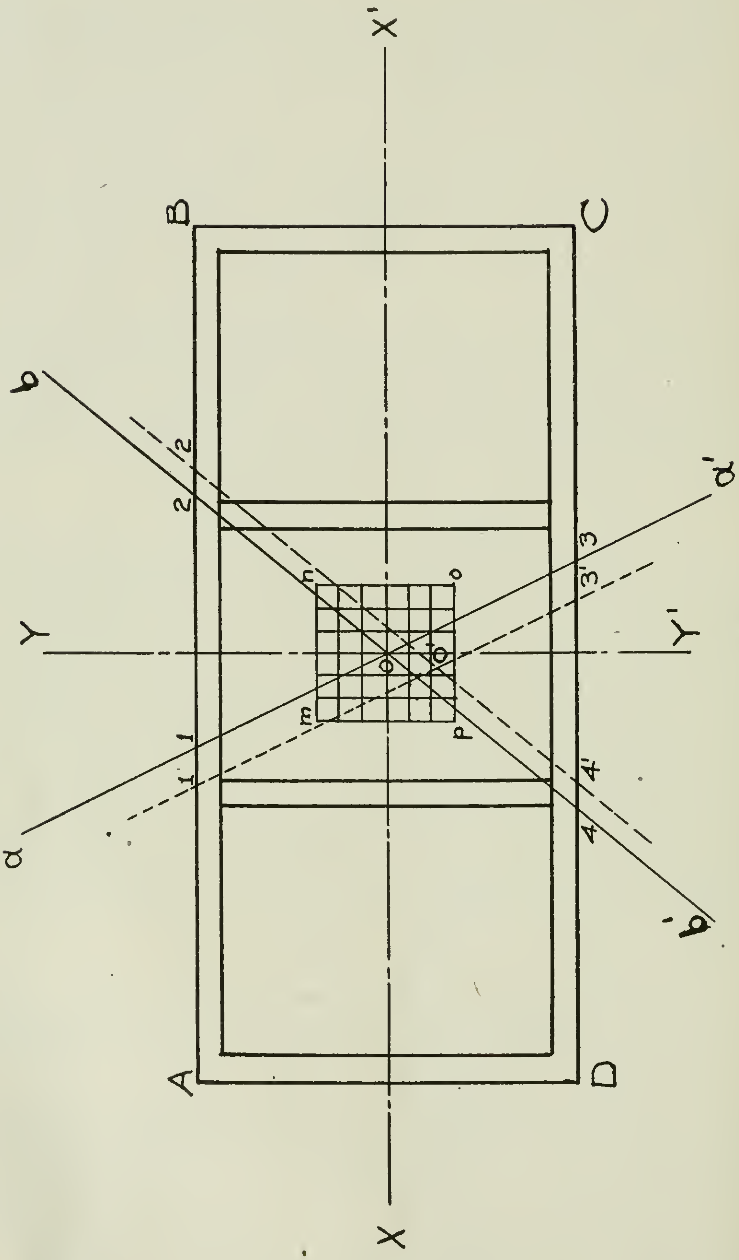


Fig. 3

happen that both of the rectangular axes of the pier can be projected over the crib. Frequently, all the lines from triangulation points will make angles with these axes. Before the work of building a crib is started, the Resident Engineer should see that the length of the diagonal of the rectangle thereof is known by his inspectors and that they check frequently the work of building by using it, in order to ensure that the men keep a true rectangle as they add the courses. If the first few courses are properly assembled, there should be very little trouble in keeping the cribs rectangular and the sides true; but if the sides once become warped surfaces, the cribs will tend to run or twist out of position as they go down; and in a high crib the bottom may be far out of the position indicated by the top. Were an 80-ft.-high crib built with a constantly-increasing error in one direction of ⅛ of an inch in 10 feet, the bottom of the crib would be 8 inches out of position in reference to the top. It is likely that many cribs have been sunk which have been built with much greater warps than that, due to careless inspection during the construction. The smaller the dimensions of a crib the more likely the men are to get a warp in it; and it requires particularly close attention to keep circular concrete shafts true while building them.

When a properly constructed crib is in correct position and truly vertical, the top of any course of timber will be horizontal; and if X X′ and Y Y′ in Fig. 3 are rectangular coördinate axes which intersect in the center of the crib, and a a′, b b′ are lines of the triangulation that intersect in the same point O as do the axes X and Y, we could place a platform on the top of the crib and on it mark out at regular intervals lines parallel to the axes of X and Y as indicated by the rectangle m n o p. The amount and direction of any movement of the crib would then be clearly indicated by the position of a mid-point of intersection for the lines a a′ and b b′ as shown in the figure at O′, but not coinciding with the intersection of X and Y. The positions of the lines a a′ and b b′ are fixed, and the dimensions and shape of the crib are maintained as nearly constant as the men can construct it. Hence, if we have a large-scale drawing of the crib, as shown in Fig. 3, on which we have marked the axes X and Y and the lines a a′ and b b′ in the position they will have when the top of the crib is in true position, and draw the cross-section lines m, n, o, p, etc., to a proper scale, we may find the position of the center of the crib, referred to the intersection of lines a a′ and b b′, at any time without placing a timber platform over the crib, as follows:

The points where the axes X and Y intersect the crib should be scribed on the outside faces of the timbers, and when the crib is in true position, the triangulation lines will cut the sides thereof in points 1, 2, 3 and 4. We shall assume that an observation has just been made, that the lines were found to intersect at 1′, 2′, 3′ and 4′, and that the distances from these points to the axes have been carefully measured along the outside of the crib. Now if we plat three of these points on the edge of our large-scale drawing, then draw two lines on a sheet of tracing cloth intersecting with the same angle as the lines a a′ and b b′, and then place the tracing cloth over the drawing and shift it until the three lines to be used pass through the three points platted, the two drawings will indicate clearly the amount and direction of any movement of the top of the crib.

The drawing of the crib and the drawing on the tracing cloth should be in ink, and the points platted after each observation should be made in pencil and erased after they have served their purpose. All the measurements made on the crib should be written in the field book at the pier, not brought in on loose scraps of paper to become lost.

Having determined the position of the top of the crib and the elevations of the four corners, the position of the bottom can be calculated by slide rule with sufficient accuracy for most cases. The advantage of this method is that the contractor does not have to stop and place a platform over the center of the crib, and the dredging need not be interrupted more than a few minutes in order to make the observation.

For the first 15 or 20 feet of sinking the position of the crib should be taken frequently, and it should never be allowed to deviate more than a few inches from the correct position. If the crib is as closely watched as it should be, the amount of deviation of its top from horizontal will be so small that the distances measured along the edges of the timber can be assumed to be of the same length as they would be if taken exactly parallel to similar measurements when the principal axis is truly vertical.

CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV MARCH 5, 1920 Number 5

HOOVER RECEIVES AWARD

The Washington Award was presented to Herbert Hoover by the Western Society of Engineers January 28, 1920, at the Hotel Sherman for "pre-eminent services in behalf of the public welfare."

Mr. Hoover's arrival in Chicago was delayed nearly eight hours, due to many train delays. As it was he reached the Sherman House about midnight.

The program of the evening was carried out as planned, addresses being made by representatives of the Four Founder Societies and Mr. C. F. Loweth of the Western Society.

Mr. Copeland, in announcing the purpose of the dinner and explaining about the Washington Award, said:

"The donor is a man who has given most generously of his time to public benefits. As a member of the Western Society I want to express to Mr. John Watson Alvord our appreciation, not only of his generosity but of the wise and intelligent suggestion that he makes as to the uses of the Washington Award."

A rousing ovation was given Mr. Alvord.

Mr. John T. Richards, associated with Mr. Hoover in the work of the Food Administration, declared that the work of the Food Administration was most marvelous. "Mr. Hoover is a man of the highest sense of honor. I do not believe he is a man of any political ambition, for he believes that the duties of his profession are sufficient. No honor could be bestowed upon Herbert Hoover which could add to the renown which he possesses today."

A telegram from the Joint Council of San Francisco Engineering Society was received at this time and read. It said:

"The Joint Council of San Francisco Engineering Society extends to Mr. Herbert C. Hoover its congratulations on this auspicious occasion. The Joint Council wishes also to express its confidence that the future holds for Mr. Hoover the broadest field for service to the American Nation."

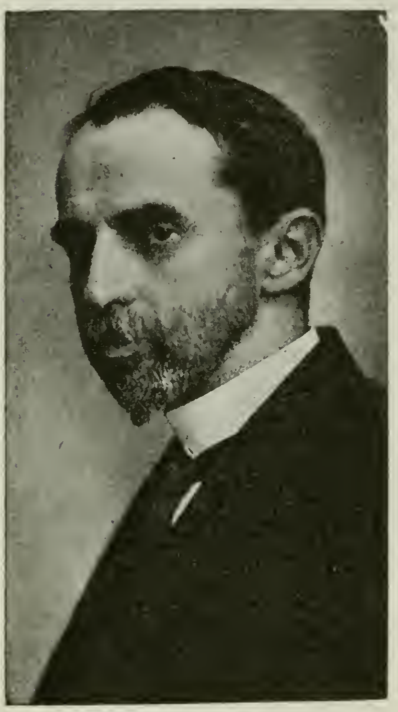
As one of the daily papers stated in its account of the dinner: "The plaster nearly came down after this message was read."

Mr. Frederic P Vose, the Toastmaster at the annual dinner of the Society, made a few remarks appropriate to the occasion, as did Mr. David Forgan.

A poem in commemoration of the

first bestowal of the Washington Award, written by Mr. James N. Hatch, was read at this time.

A telegram received from Mr. Hoover announced that the text of his speech had been released to the newspapers of the country through one of the press associations in New cieties of the country for short re- York. After some time a copy of a daily paper containing these remarks was obtained, and, in lieu of Mr. Hoover's arrival, Mr. A. S. Baldwin, Past President, read the printed statements. A program of appropriate speeches in presenting the Award had been prepared. However, in order to give Mr. Hoover all the time after his arrival, the Toastmaster, Mr. Copeland, called on representatives of the Four Founder Engineering Societies. These Societies, with the Western Society, appointed representatives, who acted as the Washington Award Commission in administering the Award according to the requests of Mr. Alvord.



John Watson Alvord

Mr. Onward Bates, "a man who has grown gray in the service, not only of the profession, but of the community," and representing the American Society of Civil Engineers, said: "We have here this evening a wonderful example of co-operation between Engineering Societies. This seems to be a very fraternal action on the part of the Western Society in inviting representatives of the four leading technical societies to share with them the honor of this Award.

"Mr. Hoover shows us by his record and his accomplishments that he is first of all a citizen, a man who has made himself, and one who has accomplished wonders as an organizer and an administrator. The lesson for us to get from his life is better citizenship. Mr. Hoover is a citizen of the world and that is the highest compliment I can pay him."

The American Society of Mechanical Engineers was represented by Mr. James R. Bibbins.

He declared that "service" permeated the programs of technical society today.

"I look upon service as one of the greatest achievements of a professional man, and certainly the A. S. M. E. is bound up in an effort to be of service to America. It recognizes services rendered in a manner entirely befitting the ideals of the engineering profession, which honors and is honored by Mr. Hoover tonight."

Mr. Bion J. Arnold, representing the American Institute of Electrical Engineers, declared that one of the greatest inspirations to the profession was the recognition of services well rendered.

"If an engineer or a body of engineers will give to the community something which that community needs, then they will undoubtedly receive full recognition of their abilities and attainments."

Mr. Hoover arrived at the Sherman at 11:45, after being met at the train by members of the Commission. On his entrance to the banquet hall he was greeted by applause and cheering lasting nearly five minutes. The Toastmaster then called on Mr. Charles F. Loweth, who as chairman of the Award Commission, was to present the tablet to Mr. Hoover.

"To the demands of all his responsibilities," said Mr. Loweth, "he has responded promptly and heartily, rendering services for world-wide welfare which has been of incalculable value, endearing his name and reflecting credit on his countrymen in the hearts of many millions throughout the world. It has been because of Mr. Hoover's extended and continuing services that earlier presentation of the Award has been impossible. We wish that this token of the Award might be of gold instead of bronze so that it might more adequately represent the appreciation of the high services he has rendered to his profession, his country and to the world."

Mr. Hoover opened his address with an apology for being late, but not an apology for government ownership of the railroads. He said he could not accept the Award for himself because in all the organizations which he has directed he has had associated with him hundreds of American Engineers; it is upon their ability and their quality for "quantitative and not qualitative thought" that has guaranteed the success of the organizations. "I can only accept this tribute as a trustee, on behalf of all those engineers who have made a greater sacrifice, perhaps, than myself in the services of humanity as a whole."

March 5, 1920

BOARD OF DIRECTION

A special meeting of the Board was held March 3, Mr. Copeland presiding. A number of new applicants were elected to membership upon recommendation of the Membership Committee.

The Chicago Plan Commission sent a communication to the Western Society expressing appreciation for the assistance given by the Society on the Chicago Plan improvement.

The recommendation of the Chicago Association of Commerce that the 1920 program for improvements to the city water supply system amount to $2,500,000, was approved. C. B. Burdick and William Artingstall were appointed members of a joint committee with the Association to consider water works improvements.

The Secretary reported that applicants who have been elected to membership, but who have not qualified, will be approached by members of the Society to secure early acceptance of membership.

It was decided to continue the Development Committee with E. T. Howson as chairman. Mr. Howson will make such additions to the committee as are needed.

The invitation of the Society to the four Founders' Societies, that their Boards hold contemporaneous meetings in Chicago at the Western Society rooms, April 19 and 20, has been accepted.

Edgar S. Nethercut,
Secretary.

PUBLIC AFFAIRS COMMITTEE

The Public Affairs Committee of the Society held its first formal organization meeting at luncheon at the Engineers' Club, March 15. This committee is to be the active representative of the Society in deliberating questions of public and civic moment. Andrews Allen, a past president of the Western Society, is chairman of this committee. President Copeland, an ex-officio member, was present at the luncheon and emphasized the important part the Western Society must play in civic affairs.

It was decided that regular luncheon meetings should be held each Monday at the Club.

Chairmen of sub-committees of the Public Affairs Committee were appointed. They are:

Sub-committee on City Zoning—Paul Green.

Sub-committee on Constitutional Convention—J. L. Jacobs.

Sub-committee on Highways—M. L. Greeley.

Sub-committee on Engineering Employment—G. W. Ristine, Jr.

Sub-committee on Urban Transportation—H. H. Easterly.

Sub-committee on Smoke Abatement—E. P. Rich.

The chairmen of these sub-committees are to appoint the members of their own units.

It was unanimously voted to lodge a protest with the Mayor and City Council against the adoption of the ordinance raising the height of buildings from 200 to 260 feet. The sense of the committee was that such a decision should be left to the newly authorized Zoning Commission after a complete survey of the city has been made.

E. H. Verrall was elected secretary of the committee. Those present at the meeting were: Andrews Allen, Paul Green, A. S. Coffin, S. I. Stocking, R. E. Schmidt, M. L. Greeley, E. J. Blair, H. H. Easterly, Albert P. Allen, Robert Knight, E. H. Heald, G. W. Ristine, Jr., W. G. Evans and Edgar S. Nethercut.

PUBLICATION COMMITTEE

The sub-committee on Publications met March 9th in the Society rooms. P. D. Van Vliet is chairman of this committee, the other members being vice-chairmen of the Society Sections and A. A. Gray and James N. Hatch members at large.

In the past one committee has had charge of the programs and publications of the Society, but due to the increase in the number of sections of the Society and the added burdens in publishing the Journal, the Board of Direction authorized the appointment of a Sub-committee on Publications, which is to become a separate committee through a proposed change in the constitution.

The form of the Journal was considered and important changes in the style and makeup suggested for adoption at the end of the present volume. The committee feels that the Journal should be the mouthpiece of the Society and should bring closer relationship among the membership. Some readjustment of the Journal, while in a desirable form now, may materially increase the interest of the members in the Journal and therefore in the activities of the Society.

The "question and answer" form in which the discussion following each technical paper is now presented is to be superceded by a "closure" bringing out the main points of the discussion. The Technical Section of the Journal is for permanent record, and for that reason should be as direct, concise and complete as it is possible to make them. The committee will also take the liberty to revise papers presented for uniformity of style. The Journal of the Western Society can and should be the standard technical paper. Comments from the members are invited as to the most suitable form of presentation of technical papers.

There are eight sections and thirty committees of the Society. News of the Sections will come to the Journal through the vice-chairmen. The Committee on Committees has, as far as it was able, appointed a secretary for each committee, whose duty it will be to report all meetings of the commiteees for publication. In this way a running account of the activities of the units of the Society will be made available to the membership at large.

It is desirable that the Journal of the Western Society be self-sustaining. It is the purpose of the Publication Committee to increase the advertising section of the Journal. Should you be called upon to assist the committee in securing advertising, your earnest co-operation is expected.

Bulletin 705, issued by the U. S. Geological Survey, Department of the Interior, is "Conservation Through Engineering," by Franklin K. Lane, now resigned Secretary of the Department.

This contains a plea for constructive policies which deserve consideration by engineers engaged in developing the resources of the country. Mr. Lane recommends a conservation program that calls for co-operation between the legislator and engineer.

Isham Randolph, M. W. S. E., recently addressed the Detroit Real Estate Board on "The Lakes to the Atlantic Waterway."

Men well trained in geology, who have at the same time the educational foundation and the point of view of the applied science man represented by the engineer, are in growing demand.

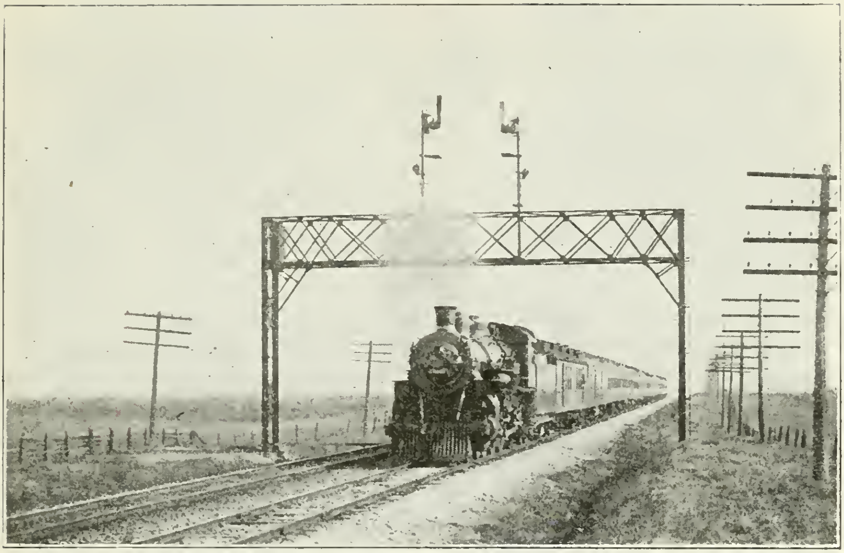
The general question of engineering education has been given careful study in recent years. The theory is held that students should have college training before taking up the engineering school work.

Engineers, it is pointed out, are coming to take a more active part in civic affairs, and this, it is said, indicates that the engineer of the future is likely to be more liberally educated than the engineer of the past.

The new type of geologist, by which is meant the geologist with an instinct for practical problems and for furnishing prompt, definite and helpful advice, has made a place both for himself and for his science where the more theoretical, or at least less practical geologist of former days failed to claim very serious attention.

Geology has become to a marked degree in very recent years an applied science. It is well understood that great numbers of so-called accidents in engineering and mining work, of calamitous or costly failures, of excessive expense and delay, of inappropriate design and plan of operation and of entirely mistaken or erroneous conception of the problem in hand have been due to ignorance of or neglect of the geological factors involved quite as often as to mistakes on the strictly engineering questions.

A dam that is built, a tunnel that is constructed, a mine that is developed, a bridge, a pier or other heavy structure that is located, or a natural resource that is exploited without due regard for all the geological conditions, cannot succeed with the same certainty that attends a proper consideration of these factors.



RAILWAY SECTION

Organization of the Railway Engineering Section, W. S. E., was completed February 23 when officers for the next year were chosen. They are:

Chairman—C. F. W. Felt.

Vice-Chairman—H. G. Clark.

Director, one year—L. J. Putnam.

Director, two years—A. G. Shaver.

Director, three years—G. P. Palmer.

There were 100 members of the Society present at the meeting, the majority of them being men well known in Chicago railroad circles.

Samuel O. Dunn, editor Railway Age, discussed "The Return of the Railroads to Private Control and Their Problems." Mr. Dunn reviewed the situation at the time the railroads were taken over by the Government. At that time there were three reasons, he stated, that caused this revolutionary change, namely, Efficient Operation, Finance and Labor Trouble.

Efficiency in operation during the war was dealt a serious blow due to the fact that many passenger trains were taken off, resulting in crowded traveling conditions. A series of unauthorized strikes seriously hampered freight service, and on some roads freight traffic was almost suspended. On the return of the railroads on March 1 to private ownership, Mr. Dunn stated that Government control showed a loss of $854,000,000, due in part to an inadequate increase in rates.

He then discussed the provisions of the Railroad bill which has recently been passed by Congress, one of them being the consolidation of the railroads of the United States into a number of systems under Government supervision, as provided for in Section 407 of the bill. In conclusion Mr. Dunn stated that this was the first constructive legislation offered the United States with regard to this problem. It was his belief that it would operate in the interests of the public and protect the transportation facilities of the nation.

RAILWAY CHANGES

The passing of the railroads of the United States from federal to private control on March 1, marked a number of changes in the management of the roads. A number of these officials are members of the Western Society.

William H. Finley, a past president of the Society, was named by the Board of Directors of the Chicago and Northwestern as President.

Other appointments on the C. & N. W. were:

L. J. Putnam, Chief Engineer; Walter J. Towne, Engineer of Maintenance; O. F. Dalstrom, Engineer of Bridges, and George W. Hand, assistant to the president.

W. B. Storey was appointed president of the A. T. & S. F., while C. F. W. Felt was retained as Chief Engineer of the same road.

C. F. Loweth retains his position as Chief Engineer of the C. M. & St. P. Ry.

Under the new organization announced by the Elgin, Joliet and Eastern Ry., A. Montzheimer was made Chief Engineer.

A. S. Baldwin is vice-president of the Illinois Central in charge of Chicago terminals.

E. H. Lee is vice-president and chief engineer of the Chicago and Western Indiana, the position he held prior to government control.

H. R. Safford has been named assistant to the president of the Chicago, Burlington and Quincy. Mr. Safford was formerly regional director of the Central Western region under federal control.

A. W. Newton is Chief Engineer and chairman of the valuation committee of the same road, succeeding W. L. Breckenridge.

R. H. Aishton has accepted the presidency of the American Railway Association.

MECHANICAL SECTION

William White, manager Hydraulic Department, Allis Chalmers Company, Milwaukee, presented a paper before the Chicago Section, A. S. M. E., and the Mechanical Engineering Section of the Western Society, on March 9, on "The Development and Uses of Niagara Falls Water Power."

Mr. White illustrated his address with moving pictures giving views of the Falls and the Niagara River at various points, showing the progress of the development and the construction of power stations.

A. L. Rice, chairman of the Chicago Section, A. S. M. E., and the Mechanical Section, W. S. E., presided. The Chicago Section appointed a Nominating Committee to report at the April meeting of the Section.

There were 200 members and guests present, including many ladies.

V. H. Manning, chief of the Bureau of Mines, has announced that petroleum research and statistical work will be included in a new branch of the American Petroleum Institute.

The Fuel Administration will be continued under Director General of Railroads Hines and a commission of four. The former will handle domestic distribution while the latter will take care of bunker and export coal matters.

Langdon Pearse, Samuel A. Greeley and Paul Hansen have established themselves as consulting engineers in the practice of sanitary and hydraulic engineering. Mr. Greeley and Mr. Hansen, who was formerly with Illinois State Department of Health as Chief Engineer, will be the active partners, and Mr. Pearse as special consultant. Mr. Pearse has been connected with the Sanitary District.

FUTURE SEEMS BRIGHT

Board and Committee Heads in Get-Together Meeting

Frederick K. Copeland, President Western Society, was host to the Board of Direction and the newly appointed chairmen of Society Committees at a dinner at the Chicago Engineers' Club, March 3.

The officials were assembled to lay plans for the various activities of the Society for 1920.

Chairmen of the committees were chosen by the Committee on Committees, A. L. Davis, Chairman. Committee memberships will be completed by the chairmen with the assistance of the main committee.

F. F. Fowle, chairman Finance Committee, reported that the annual budget is being worked out and that with the completion of the annual audit some changes might be considered in the Society's system of accounting.

The Journal of the Society is to be governed by a sub-committee on Publication headed by Paul Van Vliet and composed of the vice-chairman of Society Sections, and two members at large. Extensive plans for making the Journal the real mouthpiece of the Society are under consideration at present, Van Vliet said.

O. F. Dalstrom, as a member of the Library Committee, outlined proposed changes in the administration of the library. Andrews Allen, chairman Public Affairs Committee, made an earnest appeal for the best men in the Society as members of his unit. This is one of the most important committees of the Society and more than ever this year it will take an active interest in civic affairs.

Society members are promised plenty of diversion and recreation by the Entertainment Committee of which A. B. Benedict is chairman. J. E. Love of the Reception Committee outlined a program for making members of the Society better acquainted with one another.

Preparation of the military record of Society members, both old and new, is going forward at a rapid pace, Murray Blanchard, chairman Military Committee, declared, but information as to service records is needed from a number of the more recently elected members.

A. S. Baldwin, past president and now chairman of the Amendments Committee, called for co-operation and more complete organization of Sections of the Society. This must be done, he said, to carry out the original plans of the officers of the Society for developing its various functions.

The Young Men's Forum is to be directed by Benjamin Shapiro this year. A plea that the older members of the Society attend these meetings of the young men of the organization brought forth a hearty response. Norman Stineman is chairman of the committee arranging for co-operation with the Engineering Experiment Station of the University of Illinois. A report of the committee's findings will be sent out to the members of the Society through the columns of the Journal, he said.

W. C. Robinson, chairman Materials and Methods Committee announced that plans were being carried forward for meeting with the other technical societies interested in forming standards for building materials and methods of construction in Chicago.

J. R. Cravath was named as chairman of the speakers' bureau. W. L. Abbott, chairman Committee on National Department of Public Works, said that legislation creating this department might be expected at any time, but that meanwhile engineering societies should make a special effort to line up representatives in Congress to support the Jones-Reavis Bill creating this branch of the government.

J. F. Hayford will form a committee to study the commercial advantages of aviation. E. T. Howson is retained as chairman of the Development Committee. This committee will follow up the work begun last fall and a complete report is expected soon.

This was one of the most successful and promising meetings of the officers of the Society. Prospects for a year of service and attainment seem assured.

Those present at dinner were: F. K. Copeland, E. S. Nethercut, C. F. W. Felt, Linn White, Murray Blanchard, J. L. Hecht, A. L. Davis, Andrews Allen, F. F. Fowle, Benjamin Shapiro, P. D. Van Vliet, C. C. Boardman, W. L. Abbott, A. B. Benedict, O. F. Dalstrom, N. M. Stineman, A. S. Baldwin, Cass Kennicott, J. E. Love, E. T. Howson, J. R. Cravath, J. F. Hayford, W. C. Robinson.

WALTER J. WARDER, JR.

Walter J. Warder, Jr., Chief Engineer of Roth Bros. & Co., Chicago, died January 20, 1920.

Mr. Warder was born August 14, 1879, in this city. He was educated in the local public schools and at Lewis Institute, where he graduated as an Electrical Engineer.

He was employed by the Western Electric Company for four years, where he gained experience in the testing and design of motors and generators. He then was employed by Roth Bros. & Co. five years, in that time designing a complete line of direct current motors and generators, which machines are manufactured by the company.

He left Roth Bros. & Co. to broaden his experience and for a time was connected with the Westinghouse Electric & Mfg. Co., at Pittsburgh, Adams & Westlake Co. of Chicago, and for about three years with the Crocker-Wheeler Co. of Ampere, N. J. Leaving the electrical line, he became engaged with the Tampa Steam Ways Co. at Tampa, Fla., in ship building, and also was interested in the automobile business there.

About three years ago he returned to the electrical business with Roth Bros. & Co. as Chief Engineer in electrical and mechanical design.

Mr. Warder was particularly able in the design of direct current motors and generators and had great influence in the design of motors for elevator work, being thoroughly familiar with elevator practice. He was responsible for many developments in motor and generator design and construction. Quite a number of alternating current motors for special purposes were designed by him and much of his ability was displayed in special constructions. During the past three years of his life he was particularly interested in the development of a line of plating generators, and some very excellent designs were developend under his supervision.

He was a Fellow of the American Institute of Electrical Engineers and also a member of the Western Society of Engineers, American Society of Mechanical Engineers, the Electric Club of Chicago, the Illinois Athletic Club and a member of the various Masonic bodies.

He leaves a host of friends who were endeared to him because of his many admirable qualities.

The State of Illinois has abandoned its 1920 Highway Construction Program because of high prices, car shortage and a poor bond market, it was recently announced.

FOUR FOUNDER SOCIETIES PLAN CONTEMPORANEOUS MEETING

The Governing Boards of the Four Founder Societies will meet contemporaneously in Chicago April 19 and 20. This meeting is held on the invitation of the Board of Direction of the Western Society of Engineers.

In extending this invitation, our Board of Direction recognized the importance of Chicago as a center for Engineering Societies' activities and an opportunity for a close view of the relations of this Society with the National Societies. The plan of our Society is to unite all engineers in Chicago in one all-embracing Society for such combined action in both technical advancement as well as the other affairs of the engineer, such as his relation to the Public and his relation to his fellow engineers. The success of our plan is assured by the progress we are making.

In technical matters, through the meetings for discussion of technical papers by the various sections of the Society, and by holding these meetings in conjunction with the local sections of the National Societies corresponding to the section of this Society, we are serving the profession here. This program should be extended whenever the opportunity presents itself.

In non-technical activities even greater good can be accomplished. In these affairs, no mark of distinction is due to the technical specialty of the engineer, and, therefore, operation by a Society like ours can, and will, be more direct and prompt than any form of co-operation with groups divided along technical lines.

It is evident from the progress in arranging the year's activities that this plan is receiving the support of our members and will be effective.

There is no suggestion that our activities in either technical or non-technical matters will interfere with the Local Sections of the National Societies, but, on the other hand, will provide a common means of advancing all our interests.

In order to cement more closely the relations with the Local Sections of the National Societies through the corresponding sections we have provided that the chairmen of the Sections shall be members of the Board of Direction and also members of the Program and Publication Committee. It is to be desired that the Executive Committee of the Local Section of the National Society and the corresponding section of our Society shall be, as far as possible, identical.

Our membership campaign has brought into our Society from thirty to fifty per cent of the members of the various National Societies. We believe that the advantages of our plan will result in a membership which will include more nearly 100 per cent of the members of the National Societies, and, of course, when this is accomplished more effective work can be done.

Among our members are many who have not as yet joined any National Society. We can render these societies a service for there can be no question but, that whenever an engineer has progressed in his profession to a point where his practice falls into special lines, he should take steps to become a member of the National Society corresponding to his specialty.

These are some of the matters which should be discussed at this meeting to be held in April. A clear understanding of our inter-relations and plan for service will result in the advancement of our members in the profession and a proper recognition of the profession by the public.

March 5, 1920

JOURNAL
OF THE
WESTERN SOCIETY
OF
ENGINEERS

"To promote and advance the science and art of engineering."

THE SANITARY ENGINEER

The assertion of Dr. Victor E. Vaughn, dean of the Department of Medicine, University of Michigan, that a sanitary engineer is better fitted in the knowledge of preventives against disease than are graduates of medical colleges, not only gives educators something to think about, but likewise opens a vista of interesting possibilities to thousands of young men who are seeking a life work.

Sanitary engineering is perhaps the least crowded of all the professions. The rapid development of electricity has attracted many to that branch of engineering. The romance and great possibilities of a life in the open have induced an army of young men to become civil engineers. Mechanics and the mines have also made their appeal, but of sanitary engineers there is a scarcity.

This is, of course, largely due to the fact that this science is still in its infancy. It was not so many years ago—perhaps about the Spanish-American war period—that the real value of sanitary engineering was first recognized. The results attained along this line by the United States Government on the Isthmus of Panama came near being miraculous, and had it not been for the accomplishments of the sanitary corps during the world war, the loss of human life probably would have been quadrupled.

But sanitary engineers are few, and earnest young men are sincerely recommended to look into the possibilities which this profession offers. This is an age of prophylaxis. For years school children have been writing in their copy books that an ounce of prevention is worth a pound of cure and that a stitch in time saves nine. Sanitary engineering is the exemplification of these adages on a large scale.—*Chicago Evening Post.*

Wharton Clay, M. W. S. E., on March 1 presented a paper before the Society on "Engineering in Trade Association's Work." Mr. Clay explained the purposes of trade associations in general. Engineering has been applied to the management and promotion of these organizations, he said. It has been shown that the man with the technically trained mind is more capable of increasing the prestige and efficiency of the organization.

Application of engineering methods to such organizations has brought about closer co-operation between competitive industrial plants, he showed. Many members of certain industries now waive all claim to patent rights and exchange ideas freely now. This is especially true of the automobile industry.

Mr. Clay is commissioner for the Associated Metal Lath Manufacturers of America.

W. A. Rogers, M. W. S. E., of Bates and Rogers Construction Co., has been elected president of the Associated General Contractors of America.

There is still a vacancy on the Interstate Commerce Commission. The President has been urged to fill this important post by appointing a capable engineer, due to the administration of the new railroad bill.

NEW MEMBERS

On March 3 the Board elected to membership, to the grade indicated, the following:

1 McLellan, R. L., 6730 Clyde Ave. Member.
40 Brown, Thomas R., 4238 Grand Blvd. Member.
1058 Doherty, Russell, 218 W. Kinzie St. Jr.
1154 Reineke, Herbert M., 4616 N. Central Park Ave. Jr.
1156 Jorgensen, Adolph John, 1922 Kenilworth Ave. Assoc.
1169 Levinson, Martin C., 1907 S. Sawyer Ave. Jr.
1210 Wells, Percy A., 914 Monadnock Bldg. Member.
1215 Harris, G. W., 1023 Ry. Exchange. Member.
1305 Stannard, James M., 1220½ Monadnock Block. Member.
1347 Swanson, Earle G. L., 1537 Conway Bldg. Assoc.
1353 Hill, H. F., Chi. Tel. Co., 212 W. Washington. Member.
1354 Oliver, Earle E., 6735 Ridgeland Ave. Jr.
1362 Erbach, Charles A., Rm. 427, 140 S. Dearborn. Jr.
1366 Jenkins, A. T., 910 S. Michigan Blvd. Member.
1387 Nielsen, Waldemar, Rm. 1325, 208 S. La Salle St. Assoc.
1388 Sturges, F. D., American Bridge Co., 208 S. La Salle St. Assoc.
1389 Schmitz, Arthur R., 6838 N. Ottawa Ave. Assoc.
1393 Welter, Edw. J., 208 S. La Salle St., American Bridge Co. Jr.
1409 Cochrane, R. L., 1033 Railway Exchange. Member.
1498 Sandberg, R. L., 4951 N. Oakley Ave. Assoc.
1608 Easterly, H. H., 624-76 W. Monroe St. Member.
1623 Hedberg, G. Fred., 2852 N. Sawyer Ave. Member.
1706 Baetzmann, K. S., 2617 E. 74th Place. Member.
1753 Luther, Frank E. 1719 Peoples Gas Bldg. Member.
1788 Baker, E. P., 6843 Dorchester Ave. Member.
1861 Diskin, Cyril, 1104 N. Oakley Blvd. Jr.
1924 Gerber, Arthur U., Rm. 1237 Edison Bldg. Member.
1995 Fitch, Claude E., 1033 Elmwood Ave., Wilmette, Illinois. Member.
1987 Nelson, S. Herman, 1459 Farragut Ave. Assoc.
10 Lickerman, Leo, 5601 Calumet Ave. Assoc.
249 Koza, L. Joe, 627 Maple Ave., Wilmette, Ill. Member.
459 Johnson, E. N., 810 Old Colony Bldg. Assoc.
556 Lenish, Walter H., 645 N. Michigan Ave. Member.
656 Hobbs, Morris, 645 N. Michigan Ave. Assoc.
712 Felton, T. M., 1233 First Natl. Bank Bldg. Assoc.
787 Cutler, J. A., Johnson Service Co., 177 N. Dearborn St. Assoc.
836 Evans, F. B., 6518 University Ave. Member.
891 Calkins, Lonson D., 328 W. Washington St. Member.
892 Dickson, Robert B., 328 W. Washington St. Member.
894 Dugger, J. P., 328 W. Washington St. Member.
979 Hyatt, Jesse S., Libertyville, Ill. Member.
1019 Bird, Walter W., 544 N. Grove Ave., Oak Park, Ill. Member.
1065 Cahoon, O. B., 530 S. Clinton St. Member.
1073 McGavren, S. A., 6103 Drexel Ave. Assoc.
1077 Houston, J. E., 6514 Rhodes Ave. Assoc.
1080 Daniels, Edwin G., 10887 Prospect Ave. Member.
1081 Kraft, E. W., 520 S. Dearborn St. Member.
1086 Dresser, Alpheus C., 4448 N. Bernard St. Assoc.
1091 Nelson, V. H., 28 N. Market St. Member.
1120 Powers, J. T., 2843 N. Talman Ave. Member.
1121 Wetmore, Willard C., Peoples Gas Light & Coke Co. Assoc.
1122 Manly, F. G., 6548 S. Campbell Ave. Member.
1143 Schless, J. T., Y. M. C. A., Gary, Ind. Assoc.
1150 Andresen, Tilman, 1417 Rascher Ave. Member.
1152 Prendergast, Richard J., 104 S. Mason Ave. Assoc.
1160 Heinrich, Gustav H., 4912 N. Hamlin St. Member.

1166 Halversen, Cyrus C., 2655 N. Kimball Ave. Assoc.
1190 Peterson, Edward B., 1433 E. 67th Place. Assoc.
1194 Rutherford, G. S., 6743 Stanley Ave., Berwyn, Ill. Assoc.
1197 Kennedy, J. D., Western Electric Co., Hawthorne Sta., Chicago. Member.
1204 Heim, Carl, 2130 Lunt Ave. Member.
1205 Clark, C. W., 6437 Woodlawn Ave. Assoc.
1206 Magee, C. L. C., 1220, 36 S. State St. Member.
1235 Lindgren, Frank A., Box 104, Lemont, Ill. Assoc.
1237 McCullough, Wm. T., 9353 Ada St. Member.
1238 McKee, W. S., 1850 McCormick Bldg. Affl.
1265 Barker, T. E., c|o Miehle Printing Press & Mfg. Co. Member.
1266 Conrad, N. J., 914 Elmwood Ave. Wilmette. Member.
1267 McNally, Frank A., 123 W. Madison St. Member.
1275 Lyman, James Frank Rm. 1520, 155 N. Clark St. Assoc.
1292 Danley, John F., 645 N. Michigan Ave. Assoc.
1302 Nelson, E. B., 11177 Hermosa Ave. Member.
1309 Parker, Francis W., Jr., 1410 Marquette Bldg. Member.
1311 Brown, Arthur V., Rm. 1000, I. C. R. R., 135 E. 11th Place. Assoc.
1342 Longley, John R., 10510 S. Seeley Ave. Assoc.
1349 Lewis, Samuel R., Rm. 219, 910 S. Michigan Ave. Member.
1351 Brooks, Gale M., 1330 Corn Exchange Bank Bldg. Assoc.
1359 Berthold, G. W., 127 S. Green St. Member.
1360 French, J. C., 7714 N. Hermitage Ave. Member.
1361 Burchard, M. H., 827 Railway Exchange. Member.
1364 Price, William D., 606 S. Michigan Ave. Member.
1367 Franklin, H. B., 317 N. Waiola, La Grange, Ill. Member.
1381 Dalley, A. H. Chas., 2737 Eastwood Ave., Evanston, Ill. Member.
1382 Osterman, R. M., 801 Peoples Gas Bldg. Member.
1383 Tripp, Chester D., 943 Peoples Gas Bldg. Assoc.
1391 Hunt, Arthur T., 105 S. La Salle St., Arnold Co. Member.
1395 Pereira, Walter D., 1109 Harris Trust Bldg. Assoc.
1396 Elmes, Carleton, F., Morgan and Fulton Sts. Member.
1403 Cornell, A. M., 5253 Cullom Ave. Member.
1414 Watt, Elihu D., 111 W. Monroe St. Member.
1415 Roe, Clarence S., 720 S. Washington Ave., Lansing, Mich. Member.
1423 Hortman, Geo. F., 2200 Ins. Exchg. Bldg., c|o Robert W. Hunt & Co. Jr.
1425 Laurino, Carmine, 909 S. State St. Jr.
1426 Newlands, Norman A., 4902 N. Albany Ave. Member.
1430 Hines, Clarence W., 8821 Emerald Ave. Assoc.
1496 Holt, Thos., 600 W. Jackson Blvd. Member.
1499 Gollos, Anatol, 4651 Dover St. Member.
1512 Stedje, J. J., 3316 Sunnyside Ave. Assoc.
1656 Knowles, Richard A., 3935 Eddy St. Assoc.
1660 Stevens, Burt D., 830 Milburn St., Evanston. Member.
1685 Rosenzweig, Fred M., Roth Bros. & Co., Adams and Loomis Sts. Assoc.
1732 Hunt, Harry A., 1431 Vincennes Ave., Chicago Heights. Member.
1745 Sjoberg, Sidney T., 1400 Winnemac Ave. Member.
1752 Walton, George, 536 Lake Shore Drive. Assoc.
1754 Heil, H. Edw., 122 S. Michigan Blvd. Assoc.
1760 Waddick, James G., 6530 Ellis Ave. Assoc.
1763 Stokes, John P., 1525 S. Cuyler Ave., Oak Park, Ill. Assoc.
1794 Schermerhorn, E. E., 2745 Lincoln Ave. Member.
1816 Bakken, Arne S., 3416 N. Harding Ave. Assoc.
1864 Branum, A. M., 330 8th Ave., LaGrange, Ill. Affl.
1869 Van Buskirk, John V., 6429 Minerva Ave. Assoc.
1879 Davey, J. J., c|o Neiler-Rich Co. Member.
1882 Smeeton, Cecil B., 650 Michigan Ave., Evanston, Ill. Affl.

1893 Raymond, Arthur A., c|o Paul J. Kalman Co., Kansas City, Mo. Assoc.
1925 Laubscher, Oscar Philip, 4744 Indiana Ave. Assoc.
1930 Hammergren, Ernest B., 3409 W. North Ave. Assoc.
1989 Schnoor, Herman H., 548 Sherman Ave., Evanston. Assoc.
1994 Spies, Phil M., Peoples Gas Bldg. Assoc.
2031 Weiss, C. L., 4863 N. Paulina St. Assoc.

On March 8, the following were elected to the grade of membership indicated:

1448 Ouvig, Sherman B., 553 Elder Lane, Winnetka, Ill. Assoc.
1455 Fuller, R. F., 1800 Tower Bldg. Assoc.
1470 Hollister, Francis H., care Sargent & Lundy, 72 W. Adams St. Member.
1488 Ehrlich, Howard, 6825 Ridgeland Ave. Member.
1492 Stetson, Edward E., 1754 Bryn Mawr Ave. Member.
1516 Whitcomb, E. L., 600 W. Jackson Blvd. Member.
1522 Hess, John D., 923 Conway Bldg. Member.
1528 Hanecamp, Raymond R., 1500 Victoria St. Jr.
1531 Kumlin, George C., 2017 N. Avers Ave. Jr.
1548 Moore, J. E., Western Electric Co., Hawthorne, Ill. Member.
1561 Ransom, R. D., 7540 Murphy Ave. Member.
1565 Lundin, Elmer E., 2743 Giddings St. Jr.
1590 Rowe, Harold E., 6101 Woodlawn Ave. Assoc.
1595 French, Burton, 14 S. La Salle St. Member.
1610 Maddox, Edward Morton, Rm. 624, 76 W. Monroe. Member.
1646 Combs, Stuart, 6127 Woodlawn Ave. Assoc.
1742 Roffee, Barton E., 72 W. Adams St. Member.
1866 McMahon, C. C., 215 S. Morgan St. Assoc.
154 Nelson, Wm. H., 3240 Michigan Blvd. Assoc.
277 Russell, Clabren B., 431 S. Dearborn St. Member.
288 Brown, Ray C., 5142 Broadway. Member.
575 Buffington, C. L., 1207 Marquette Bldg. Member.
820 Walter, George S., 38 S. Dearborn St. Member.
821 Jenks, A. P., G. E. Co., 1016 Monadnock Block. Member.
883 Ford, Clem C., 1858 McCormick Bldg. Member.
889 Williams, William J., 1549 Otis Bldg. Member.
1076 Wurst, Frank L., 1039 W. 70th St. Assoc.
1078 Donohue, W. J., 6144 Dorchester Ave. Assoc.
1209 Eagen, H. I., Rm. 1101, 189 W. Madison St. Affl.
1249 Byler, A. D., 38 N. Market St. Member.
1272 Field, Horace H., care Norton, Bird & Whitman, 111 W. Monroe. Member.
1304 Johnsen, J. A., 2449 N. Tripp Ave. Assoc.
1352 O'Connor, James T., 3505 Hemdon St. Assoc.
1356 Ziegweid, Anton B., 5311 Ellis Ave. Member.
1358 Russell, Leslie A., 4255 Broadway. Assoc.
1377 Stevens, Leonard J., 30 N. Michigan Ave. Member.
1390 Stevenson, J. C., 30 N. Michigan Ave. Member.
1397 Martin, Winsor, 1900—208 S. La Salle St. Assoc.
1402 Bledsoe, Carl F., 28 E. Jackson Blvd. Member.
1411 Maiwurm, Arthur B., 739 Van Buren St., Oak Park, Ill. Assoc.
1416 Benoit, Wm. E., 219 W. Congress St. Member.
1421 Cook, Percival Edgar, 3141 S. Hoyne Ave. Assoc.
1433 Burnett, John R., 8123 S. Sangamon St. Member.
1447 Satterlee, Hugh Wendell, 422 N. Parkside Ave. Assoc.
1497 Brock, E., 600 W. Jackson Blvd. Member.
1501 Gilbert, Henry C., Jr., 814 Windsor Ave. Member.
1525 Johnson, J. T., 4436 Sheridan Rd. Member.
1532 Caveney, Wm. J., care Sinclair Refining Co. Member.
1533 Briggs, Chauncey M., 5557 University Ave. Assoc.
1535 Stone, Albert G., 1043 E. 42nd Place. Assoc.
1536 Hess, Walter, 4717 Sheridan Road. Assoc.

1564 Schroyer, C. A., 181 N. Kenilworth Ave., Oak Park, Ill. Member.
1568 Marshall, Frank O., 701 Pullman Bldg. Assoc.
1571 Munn, Edward A., 4654 W. Lawrence Ave. Member.
1572 Laws, Theodore, 2637 N. Kimball Ave. Member.
1582 Baughman, Ralph H., 1217 Lumber Exchg. Bldg. Assoc.
1591 Janicki, John, 3815 W. Congress St. Member.
1598 Chambers, Wm. R., 1830 W. 104th St. Member.
1599 Floyd, Geo. G., 1150 McCormick Bldg. Member.
1600 Lofts, David, American Steel Foundries, 332 S. Michigan Ave. Member.
1609 Choate, Rufus C., 624-76 W. Monroe St. Member.
1620 Trowbridge, Chas. B., 4738 Magnolia Ave. Member.
1658 Knapp, Chas. S., 820 Pullman Bldg. Member.
1698 Algeo, Harold L., 4050 Kenmore Ave. Member.
1738 Nelson, Arthur D., 357 Cumberland Ave., Kenilworth, Ill. Member.
1739 Vozrle, Albert J., 5941 S. Sangamon St. Assoc.
1741 Kuhn, A. R., 7552 Howard Ave. Assoc.
1873 Henze, Carl, 1129 Monadnock Block. Member.
1895 Williams, Sidney J., 168 N. Michigan Ave. Member.
2041 Sullivan, Arthur, 6719 Chappel Ave. Member.
2069 Beatty, Jas. W., 7721 Peoria St. Assoc.

NEW APPLICATIONS

The following applications for membership were presented to the Board of Direction March 8:

46 T. P. Stypzyuski, Chicago.
47 C. A. Budd, Chicago.
48 Owen Trabue Leavenworth, Oak Park.
49 Maro Johnson, Iowa City, Ia.
50 Herbert H. Sherer, Chicago.
51 W. G. Rudd, Chicago.
52 James Wm. Strickler, Chicago.
53 Thomas H. McSheehy, Chicago.
54 Chas. R. Ferguson, Chicago.
55 Walter S. Hayford, Evanston.
56 Edward W. Menke, Chicago.

FROM ENGINEERING COUNCIL

A bill has been introduced in the House extending the life of the National Screw Commission for two years from March 21, 1920.

A national budget measure has been agreed to by a sub-committee of the Senate Finance Committee. Its provisions are more drastic and much broader than the budget bill passed by the House.

Metric legislation is being compiled into bill form for introduction into the House of Representatives. This kind of legislation has been introduced in the House during the last 15 years but no action has resulted from it. Compulsory use of the metric system will be fought by representatives of industry because of economic conditions and the fact that international trade demands make such a plan inadvisable.

Chicago Chapter of the American Steel Treaters' Society held their March meeting at the City Club, March 11. A. N. Conarroe of the National Malleable Castings Co. gave an interesting talk on "Some Problems in the Annealing of Cast Steel." The lecture was illustrated with slides.

The Director of Sales, War Department, announces that 200 Decapod-locomotives built for service on Russian roads, will be offered for sale by the Chief of Engineers, United States Army. These locomotives are now in service on American railroads. Gauge and coupling devices having been altered to the standards of domestic lines. They are to be sold by informal bids and negotiations.

EMPLOYMENT SERVICE

NO CHARGE is made for opportunities announced in this section of the Journal.

ANNOUNCEMENTS must not be more than sixty-five words in length and will not be inserted more than twice during a period of two months, during which time all records will remain in the active files. All correspondence will be treated confidentially.

APPLICANTS for situations, not members of the W. S. E., must have card of introduction from a member of the Society.

ALL REPLIES should be addressed to the key number indicated, in care of Employment Bureau, Western Society of Engineers, 1735 *Monadnock Block, Chicago.*

SITUATIONS WANTED

B-300: CIVIL ENGINEER, SEVEN years experience, now employed as City Engineer and City Manager, city of 7,000, wants position as construction superintendent or sales engineer. Age 28, married. Salary $300 per month.

B-301: SITUATION WANTED—By man of 31 who has had good practical training in civil engineering. Ten years experience as field engineer and draftsman.

B-302: GRADUTE C. E., AGE 27, desires position where initiative and executive ability as well as sound technical knowledge are required. Experienced in heavy construction, location and plant operation. At present located as supervising engineer on plant management and design involving heavy dredging and excavating operations.

B-303: GRAD. ARCH. ENG. DEsires position as superintendent or assistant in building construction. Six summers with small contractor, nine months designing reinforced concrete structures.

B-304: MECHANICAL ENGINEER. Fifteen years experience in power and mechanical construction. Ten years as superintendent of construction and operation of gas and steam power and air compression plants. Will accept position as superintendent of construction, mechanical engineer or master mechanic.

B-305: GRAD. C. E., U. OF ILL., six years experience on railroad drainage, sewers, roads and pavements, surveys, topography, mapping, design, estimating and construction, desires position as city engr. or asst., preferably in small city. Salary $250 per month.

B-307: GRADUATED M. E., YALE. Nine months in U. S. Army Service; Asst. to Elec. Eng. at Conn. shipyard. Traveling salesman in Illinois and Iowa selling warm air furnaces to dealers. Wishes any engineering position.

B-308: GRADUATE E. E. ARmour Inst.; telephone engineer four years. Consult. Engr. and Supt. of mfg. plants, wood working industry. Desires position in wood working field where past experience may be applied.

B-309: GRAD. ARMOUR INST. desires position with architectural firm. Understands drafting, designing, detailing and general work. Licensed arch. exam, 1917. Salary $250.

B-310: EXPERIENCED M. E. CApable of handling general mechanical problems and special structural construction desires position. Can handle men and experienced in supervising, designing, estimating or constructing.

B-311: MECHANICAL ENGINEER, experienced in design, contracting and installation of power plants, heating, plumbing and mechanical equipment of buildings, desires executive position or to act as selling representative in Chicago and vicinity.

SITUATIONS AVAILABLE.

A-30: WANTED—YOUNG MAN capable of making drawings from designer's sketches for Engineering Dept. Estimating and working eventually into Engineering Sales Dept.

A-31: TECHNICAL GRADUATE —Young man, technical education, civil or mechanical engineer graduate preferred, for office position with leading Chicago iron and steel concern doing country-wide business. Offers technical and commercial training; excellent opportunity to learn the heavy steel line; good prospects for advancement with a concern whose policy is to develop its own men for responsible positions. State experience, if any, education, salary expected.

A-32. LARGE ENGINEERING concern desires several Architectural, Structural Steel and Structural Concrete draftsmen.

A-33: WANTED—STRUCTURAL draftsman familiar with railroad buildings such as engine houses, small roadway buildings, shop buildings, etc.

A-34: WANTED—DRAFTSMAN or designer. Prefer M. E. graduate capable of designing. Applicant should be experienced with Rolling Mill and Wire Mill machinery, heating furnaces, boiler plants, mill buildings and general mill work.

A-35: WANTED—TWO GRADUATE civil engineers of three years experience in railway work, preferably in field construction or maintenance. Man must have desire for editorial work, with high publishing company.

TECHNICAL SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

VOLUME XXV. MARCH 5, 1920 NUMBER 5

The Inter-relationship of General Industry and Food Production and Distribution

BY HERBERT CLARK HOOVER,
President, American Institute of Mining and Metallurgical Engineers.

Presented February 28, 1920.

I BELIEVE that I appear before an assembly of engineers in two aspects: first, as a fellow engineer of some experience in industry; and, second, in the aspect of a citizen of some experience in food problems. I propose, on this occasion, to discuss the inter-relationship of general industry and food production and distribution. Particularly as to the necessity of a fair balance between general industry and agriculture and the need to maintain this balance by securing to the farmer more economy in the distribution of his products. There are not only engineering problems involved in this relationship, but there are great social and political issues of the first importance.

In order to avoid repetition of long phrases, I propose to use the term "agriculture" as referring to the agricultural industry, and to use the term "industry" as limited to the production and manufacture of non-food materials.

The outstanding feature of civilization during the last century has been the increasing growth of industry as distinguished from agriculture. Many states have stimulated this side of national life until they have built up their populations far beyond the capacity of their land. We have the most profound instances of this in England and Germany. In these states the population is today dependent upon the import, mostly from overseas, of from 30 to 70 percent of different food commodities through the exchange of industrial products. The very life of their people is thus dependent upon maintaining open the free access to overseas markets. From this necessity have grown the great naval armaments of the world, and the burden that they imply on all sections of their population. Such nations, of necessity, have engaged in fierce competition for markets for their industrial products. They have thus built up the background of world conflicts. The titanic struggles that result have endangered the very lives of their people from starvation. Their war tactics have in large degree been directed to strangle food supplies.

One other result of this development has been the terrible congestion of populations in manufacturing areas. All such congested populations are periodically subjected to low standards of living, of housing and other conditions of life, which make for physical and moral degeneration. In times of industrial prosperity, the standard of living increases in these manufacturing areas, but in times of industrial depression they only maintain themselves by the practical sweating of the workers. Beyond this, there is another jeopardy which has received too little attention. In times of industrial depression, whether brought about by war or by the ebb and flow of world prosperity, these populations, oppressed with misery, turn to political remedies for matters that are beyond human control. They naturally resent the lowering of their standards of living and they inevitably resort to industrial strife, to strikes and disorder. Their productivity, upon which the very life of the nation depends, again decreases, and their ability to buy food from abroad decreases in train with their fallen productivity, because they decrease the production of goods to send in exchange. One other result of large industrial development is that in times of industrial prosperity when the standard of living rises in general industry, it attracts into its radius the agricultural population, and immediately creates inroads into agricultural production. To some extent this is a natural balancing of forces which tends to stabilize itself in time. But there are social and political phases more important than sheer economic balances.

Years ago our predominant export was food. Then we turned to importing mouths for an expanding industry and our net export food surplus diminished to a low ebb until the beginning of the war, when it received a special and temporary stimulus. By and large our industries have been in a high state of prosperity. More favorable hours, more favorable wages, are today offered in industry than in agriculture. The industries are drawing the workers from our farms. If this balance in relative returns is to continue, we face a gradual decrease in our agricultural productivity. If we should develop our exports of industrial commodities during the next five years as rapidly as we have during the past five years, we shall by that time be faced with the necessity to import foodstuffs.

Some economists will argue, of course, that if we can manufacture goods cheaper than the rest of the world and exchange them for foodstuffs abroad, we should do so. But such argument again ignores certain fundamental social and broad political questions. These dangers have become more emphasized by experience of the war. From dependence on overseas supplies for food, we will, by the very concern that will grow in public mind as to the safety of these supplies, soon find ourselves discussing the question of dominating the seas. Our international relations will have become infinitely more complex and more difficult. Unless the League of Nations serves its ideal, we will need to burden ourselves with more taxation, to maintain great naval and military forces. But of far more importance than this is that social stability of our country, the development of our national life rests in the spirit of our farms and 'surrounds our villages. These are the sources that have always supplied our country with its true Americanism, its new and fresh minds, its physical and its moral strength. Industry's real market is with the farmer by the constant increase of his standard of living. We want our exports to grow in exchange for commodities we need from abroad, but we want them to grow in time with our social and political interests and to do so they must grow in step with agriculture.

Therefore, when we sit down to consider our reconstruction policies from the war—when we sit down to plan the future development of our country—our first thought should be of the state of our agricultural industry. For the last three months I have been a member of the industrial commission at Washington, endeavoring to find some solution for the conflicts and social wrongs that have grown up in our industrial community. Great as is the need for constructive thought with regard to its weaknesses, the need for similar thought and similar activity is still greater with regard to agriculture.

The prime problem is to make the agricultural industry economically attractive so that it draws into its service its full proportion of American life,—so that it can keep pace with industry in its rapid development. When we come to the consideration of practical measures we soon arrive at two primary facts. The first is, the farmer's main production must find its market either in the great industrial centers along the Atlantic seaboard or, alternatively, in export to Europe. In either case, the prices in normal times are made primarily by competition with the other great sources of the world's food supply. His prices are thus only remotely regulated by the cost of production. Strict economists will argue that if the prices are unprofitable to the farmer it will ultimately correct itself by diminished production and consequent general rise in the world level of prices. Amongst the complex flow of economic forces today, these results come very slowly and in the meantime the actual result is mainly a decrease in the standard of the farmer's living. For the farmer must plant and gamble in advance on the demand. He cannot decrease his production to meet such contingencies with the facility of organized industry. Whatever the economic argument may be, the outstanding fact is for all practical purposes the farmer's level of prices is made by the world prices of food as interpreted at the point of delivery, and during wide periods of time he is underpaid. On the whole he has not been underpaid during the war, but recently the tide has begun to turn against him.

The second great fact that would be developed in inquiry is that the American farmer receives a less proportion of the consumer's purchase price for his product than the farmer of most other civilized countries. That is, the margin between the farmer and the consumer is the widest in the world. This margin comes partly out of the consumer, but predominantly out of the farmer, for, as I have said, the prices to the consumer in the great food commodities in normal times are fixed by world forces. If we assume the basis of price is not to be remedied, the line of practical remedy to the farmer lies in decreasing the cost of placing his products into the hands of the consumer. Every cent that we can decrease this cost contributes to the consumer but even more largely to the farmer.

If we analyze the weaknesses of our system of distribution, we can, for purposes of discussion, divide it into three phases: their transportation, their manufacture in preparation for the consumer, and the agencies of distribution.

Our transportation has been under continuous discussion for forty years with ever tightening regulations. I believe the great majority of our people are opposed to nationalization. Nevertheless, I doubt whether there is anyone in the United States who is not completely seized with the necessity of rigorous regulation. We are about to return the railways to private ownership under generous terms and, as I have said elsewhere, private ownership is now on its final trial. The proprietors have now to demonstrate their initiative; that they can maintain a right relation to their employes; that they can maintain their administrative efficiency; that they can keep out of national and local politics; that they can conduct these operations in the sense of complete service to the community. If it shall fail in this latter respect, our people in reaction will probably be prepared to sacrifice something of its ideals in other directions, for the supreme test of efficiency is human service.

I wish to point out one weakness in our present railway situation as bearing upon the farmer. Everyone knows of the annual shortage of cars during the crop moving season. Few people, however, appreciate that this shortage of cars often amounts to a stricture in the free flow of commodities from the farmer to the consumer. The result is that the farmer in order to sell his produce, often unknown to himself makes a sacrifice in price in local glut. The consumer is compelled at the other end to pay an increased price for foodstuffs due to the shortage in movement. In proof of this, on one occasion a study was made under my administration into the effect of car shortage in the transportation of potatoes and we could demonstrate by chart and figure that the margin between the farmer and the consumer broadened 100 percent in periods of car shortage. Nor did the middle man make this whole margin of profit, because he was subjected to unusual losses and destruction and took unusual risks in awaiting a market. The same phenomenon can be proved at times of shortage of movement in corn and other commodities.

The usual remedy for this situation is insistence that the railways shall provide ample rolling stock, trackage and terminals to take care of the annual peakload. This, however, imposes upon the railways a great investment in equipment for use during a comparatively short period of the year when many commodities synchronize to make the peak movement. It imposes a burden on the entire cost of transportation. This burden of extra equipment will probably always be held to so low dimensions that we will never escape the annual delays in transport and stricture in market. Aside from this question of a peakload, we have no doubt fallen behind in the provision of even normal railway equipment during the war. I would like, however, to recall another partial remedy for this situation advanced many times by our engineers. That is, the possible help from improving of the waterways from the Great Lakes to the Atlantic seaboard by way of the St. Lawrence river so as to pass full sea-going cargoes. It has already been determined that the project is entirely feasible and at comparatively moderate cost. The result would be to place every port on the Great Lakes on the seas. Fifteen states contiguous to the Lakes could find an outlet for a portion of their annual surplus quickly and more cheaply to the overseas markets. The result would be to take off a considerable portion of the peakload on the trunk line railways during the great crop movement season. It would contribute materially to reduce this effectual stricture in the free flow of the farmer's commodities to the consumers. Of far greater importance, however, is the fact that the costs of transportation from the Lake ports to Europe would be greatly diminished and this diminished cost would go directly into the farmer's pockets. It is my belief that there is a saving of five or six cents a bushel in the transportation of grain. Although a comparatively small proportion of our total grain production flows to Europe, I am convinced that the economic lift on this minor proportion would raise the price of the whole grain production by the amount of saving in transportation. The price of export grain in Chicago in normal times is the Liverpool price, less transportation and other charges, and if we decrease the transport in a free market the farmer should get the difference. Not only should there be great benefits to the agricultural population, but it should be a real benefit to our railways in getting them a better average load without the cost of maintaining the surplus equipment and personnel necessary to manage the peakload during the fall months. It has been computed that the capital saving in rolling stock alone would pay for the entire cost of this waterway improvement over a comparatively few years.

The matter also becomes of national importance in finding employment for the great national mercantile fleet that we have created. In other words, instead of expending vast sums on the development of our tracks, rolling stocks, terminals, of the trunk line railways, that we should effectually substitute the other arm of transportation which we have already built, that is, our fleet.

Another factor in transportation bearing upon the problem of marketing is the control of food manufacturing and marketing concerns of refrigeration and other special types of cars. This special control has grown up largely because, owing to seasonal fluctuations over different roads, no one railway wished to provide sufficient special cars and service for general use by all manufacturers. The result has been to build up the domination of certain concerns and stifle free competition. Much the same results have been attained by special groups in control of stock yards and, in some cases, of elevators. Where such formal or informal monopolies grow up, they are public utilities and if the farmer is to have a free market they must be replaced by constructive public service.

The second point of attack in reduction of the cost of marketing farm produce lies in the insistent removal of every impediment to free trade in produce. We have some commodities where manufacture has grown into such units that these units exert such an influence that they can consciously or unconsciously effect the price levels of the farmer's produce. Again I am not a believer in nationalization as the solution, but I am a believer in regulation. The experience which I gained in the Food Administration on these problems during the war led to the feeling that I have expressed at that time, that such business should be confined to one line of activity just as we have had to confine our railways, banks, and insurance companies. Even this may not prove to be sufficient protection to free market by free competition. If we have to go to regulation, however, it is my belief that it should be confined to overswollen units and that the point of departure should not be the amount of capital employed but the proportion of a given commodity that is controlled. The rates must depend upon the commodities in point. When such a concern obtains dimensions that it can influence prices or dominate public affairs either with deliberation or innocence, then it must be placed under regulation and restraint. I think our people have long since realized the advantage of large business operation in improving and cheapening the cost of manufacture and distribution but when these operations have become so enlarged that they are able to dominate the community, it becomes of social necessity that they shall be made responsible to the community. The test that I would apply, therefore, is not the size of the institution or the volume of capital that it employs, but the proportion of the commodity that it controls in its operaions. It is my belief that if this were made the datum point for regulation, and if regulation were made of a rigorous order, this pressure would result in such business keeping below the limit of regulation. Thus the automatic result would be the building up of proper competition because men in manufacturing would rather conduct a small business free of governmental regulation than to enjoy large operations subject to governmental control. In other words, what we fundamentally want is to be free from domination of any artificial impediment in the free flow of commodities to the consumer.

The third point of attack at reduction in the cost of marketing is the most difficult of all. It lies in the fact that we have too many people engaged in distribution of food supplies. This is particularly the case in the retail end of distribution. There is one town in the United States that had one meat dealer to every 400 of population—and although their margins were very wide none of them made more than a bare living. The numbers engaged in distribution have naturally increased rapidly during war inflation and speculation such as we have gone through in the last five years. In such a period, much profits are earned by the simple process of marking up the price of the goods on the shelf to the cost of replacements. I am not at all sure that we shall not find a great measure of remedy, both to the producer and the consumer, now that the tide of inflation must soon turn, and there may be a process of marking down the price of the goods on the shelf instead of marking them up.

In this connection, it is worth noting that although agricultural products increased yet the total commodity production of the United States has decreased by nearly 7 or 8 percent during the past eighteen months. At the same time deposits in our credit banks have increased by nearly twenty percent. No one can defend this terrible increase of inflation since the armistice. It is scarcely possible for a dealer in commodities to have escaped this magic wand of profits. If we have a wise and steady reduction in inflation, it will be a skillful dealer who escapes a reduction in the scale of profits. Whatever the result of this process may be to the distributor, it will reduce the margins between the producer and the consumer. It may also reduce the numbers of the persons engaged. Great wisdom will be required on the part of our government in its great control of credit that this deflation shall take place progressively and with care, in order that there shall be no sudden breaks with their resulting demoralization, unemployment and misery. One of the most effective measures in reduction of the cost of distribution has been co-operative distribution among producers. We have some successful marketing co-operatives. They have proved their value both to the producer and the consumer. We have, however, never had the development of co-operation to the extent that European farmers have attained. To reach its best results, co-operation must grow on parallel lines by the consumers. As co-operative marketing does not reduce initiative or competition, I have never seen the bogie of socialism in it.

There are other directions by which the costs of distribution can be constructively reduced on behalf of the farmer and consumer. For instance, many of our products are unstandardized; if they were standardized they could be sold by contract instead of by doubtful inspection on delivery.

We need an exhaustive economic and practical investigation into our great national boards of trade, with view to extending their legitimate functions or preventing their abuse. The economic value to the farmer of having a daily national price created by the ebb and flow of absolutely untrammeled trade in central markets has never been fully appreciated. In commodities where such trading is wholly or partly unorganized, neither the farmer nor the consumer has any protection as to determination of the right price and the margins between consumer and producer widen at once. Wider margins between producers and consumers is always a measure of hazards. When there is free and public market these hazards decrease. The abuses of exchanges lie, of course, in the possibility of manipulation of their processes to create artificial prices for speculation. It is within their own powers, and there is a growing tendency among them to eliminate these abuses. The war proved a great laboratory of experience in these matters, and the whole subject needs study and review.

Another field of interest in agriculture to engineers lies in its mechanical equipment. Our American engineers have replaced manual labor by machines to a remarkable degree. This mechanical development has raised the whole economic and social status of our farmers to a point far above his European cousin. There is yet a great field of engineering for further assistance to the whole industry.

It is in all these directions that I believe lies the best field for restoration of balance between agriculture and industry. We want our industries to develop, but we want agriculture to keep pace. So long as we can feed our industrial population, the greater industry grows the greater is our whole community.

The organization and the processes of production and distribution are of centuries of development. This economic organism has come to have an extreme delicacy in its adjustment, in its response to stimulus, to effort, to the ability and character of all of the varied members of our community. Sudden disturbance and the introduction of "isms" into this delicate organism can only bring us difficulties—can only reduce our productivity and tax our entire standard of living. We want to improve our machinery, we do not want to tear it down. Nor do we want it owned or run for the benefit of a few. The whole impulse to the maximum functioning of our productive machine lies in the self-interest of its members. It will never function on the basis of altruism. If we would have it function properly, we must promote that equality of opportunity which allows every member of this community to attain that position to which his abilities and character entitle him. To me, therefore, the test of the rightness of any measure is that it shall maintain and build up this equality of opportunity, that it shall preserve the initiative of the whole population. When we apply this test to governmental activities, I think we will find that it reaches its ideal more in negative than in positive action; that it should become positive only when the initiative—such as a Panama Canal—is beyond the capacity of individuals or groups; that it receives its best exemplification in wise regulation against the shackling of the flow of competition, the advancement of understanding of the processes of production and distribution, stimulus to their improvement, the removal of impediments to its development, in creating in it all a pride of service to the community.

The Engineers' Trust

By A. Stuart Baldwin, *President, 1919.*

Delivered at Annual Dinner of the Society, January 28, 1920.

SINCE I had the pleasure of addressing you upon my inauguration as your President, just a year ago, your Society has taken on new activities and entered upon a larger growth and a broader field of usefulness.

Your directors, feeling that the time was ripe for engineering advancement, appointed a Development Committee to study the status of engineers in this large manufacturing center, and thereafter entered upon a campaign for bringing together the engineers from all branches of the profession, organizing them into one great Society, and so co-ordinating their activities as not only to gain professional prestige but to function as a strong and useful member of the body politic. A most excellent beginning has been made. Your membership in all grades has been nearly trebled. As rapidly as practicable the new members are being organized into the work of the Association. In the meantime we must ask for their patient co-operation in bringing that about. Many details are necessarily gone through with before à complete organization can be effected with such a large proportion of new members.

Three new sections have been formed and we now have in the Society the following Engineering sub-divisions:

New
- Telephone and Telegraph.
- Railroad
- Industrial

Formerly existing
- Hydraulic, Sanitary and Municipal
- Electrical
- Mechanical
- Bridge and Structural and the
- Gas Sections.

The membership is still growing and we look forward at no distant day to doubling the number that we now have, our investigation showing that there are many more than 6,000 Engineers in this immediate manufacturing territory eligible to membership in this Society. With the membership well rounded up and organized the next important move should be the construction of an adequate building as an engineering center.

With so large a membership the work of your Directors and Executives must to a much greater extent be de-centralized and thrown upon the heads of the Sections, each of which must become to a certain extent a self-contained Engineering Society in its own specialty, all co-operating for the common good. If each Section were the working local branch and representative of the National Society with which the most of its members are affiliated, and if each National Society would father each Section and become its working associate, it can readily be seen that the Sections would become tremendously stengthened, and thereby serve not only to strengthen the Western Society of Engineers, but as a reservoir from which the National Societies would gain strength and inspiration. The National Societies have all of them need for local work on the part of their members. The opportunities for getting together nationally occur but a few times during a year at best, whereas local Sections should be able to meet monthly or even more frequently if necessary. It will undoubtedly be found that those members of a National Society who are able to get together locally most frequently for papers, discussions and consideration of Society matters, will be the most influential in the affairs of that Society.

I therefore take this opportunity to charge you gentlemen who are the heads of Sections with the extreme importance of your positions. The opportunity offered is a challenge to your powers of organization and development. The new members should be quickly organized into working units, each Section striving for additional members, each striving to work up harmonious relationship with the National Society which it represents and each endeavoring to furnish matters of special interest and usefulness to its particular membership.

The Society has been greatly helped and encouraged by the establishment of the "Hunt Award" by our former President and long time loved and honored member, Capt. Robert W. Hunt, at one time President of the American Institute of Mining and Metallurgical Engineers and again of the American Society of Mechanical Engineers; engaged in many affairs of public importance, he has not allowed the national honors that have been conferred upon him to wean him from the interest and affection which he has always displayed for this Society, and now as a crowning event in his carerr with us, he has provided a perpetual award and incentive to high endeavor to the younger men of our profession. This award will largely benefit the Mechanical Section, but other Section members should immediately bend their efforts toward obtaining similar endowments for the benefit of the members of their particular Sections.

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We have this year been celebrating the 50th Anniversary of the founding of this Society.

As we look back upon the fifty years that have passed and give consideration to the advances that have been made by and through the profession of Engineering during that period of time, imagination falters at the thought of what may be brought to pass in the fifty years that are to come.

Of the great forces that function in the life of man today, as a matter of course and indeed as a matter of necessity in the advancement and preservation of life and man's activities, but few had been initiated, much less brought to their present stage of development, fifty years ago. If the Engineers of that day could have picked up one of the modern Engineering Journals, the mass of advertisements with which its bulk is largely filled, much more the technical literature contained therein, would relate to matters of which they had no understanding or conception. Well may we ask ourselves the question: "If this *Semi*-Centennial has witnessed such Engineering advancement, what indeed may be the development that will take place before *the Centennial* event that few of us now present will be here to celebrate?" And yet marvelous as is the Engineering development to be anticipated, there may be still more revolutionary developments during the next fifty years in the relationship between the Engineer and his clientele or employer, between man and man. Until within comparatively recent years the relationship between Capital and Labor had witnessed no very radical changes; the gradually improving educational advantages conferred upon Labor bringing an equally gradually increasing intelligence that was elevating labor and bringing it more and more into position to exact a fairer division of wealth; but with the great war these changes have become revolutionary in character and society is threatened with a power that uncontrolled is quite as sinister in its threat upon liberty as was autocracy or accumulted wealth in the hands of the few. Undoubtedly the great middle class, between Capital on the one hand and Labor on the other, has been benefitted by the solid phalanx which Labor has presented against the encroachments of Capital far more than has been appreciated, because had there been no resistance from Labor those encroachments would have trended upwards, class by class, and more and more would the arts and professions have suffered. Now that the tide has turned the middle class will be the first to feel the effects, because the increase in the emolument for Labor comes first from the necessities of life in the class next higher up, while from the wealthy it comes from luxuries or accumulated surplus.

These changes are most significant to the Engineer, whose duty it is to stand between Capital and Labor, interesting and representing the former in the design and execution of works and furnishing supervision and employment to the latter.

If the Engineer is to be the really useful citizen, what must his function be in bringing about co-operation and co-ordination of effort between these two extremes? *Are* these extremes to be brought together, or will the struggle between them result in that decadence of civilization that the world has witnessed before in many cases, but which we have fondly believed to be impossible in our times? In the great war just closed so horribly and brutally destructive were the acts of the common enemy, so enormous was the slaughter, so terrific the devastation, that one frequently heard the statement that "civilization was endangered." And this provokes the thought, "*Is* there, *can* there be a possibility that the great works of man we now see, the mighty engines of power, the great vessels that float the sea, the conquest of the air and of the waters under the earth, can vanish and leave only traces that savants of future ages will put together and draw deductions from as to the *kind* of man that brought them forth and the age in which he lived?" Anthropologists tell us that we now have indisputable evidence that in prehistoric times wave after wave of civilization was followed by corresponding periods of barbarism, and the distinguished Dr. Petrie speaks of civilization as "an intermittent phenomenon."

The no less renowned Dr. Spurrell tells us of a certain civilization forty centuries before the birth of Christ in which elaborate houses of as much as four stories were built with staircases, bath rooms and water closets on several stories provided with apparatus for flushing and sanitary arrangements equalled only in modern times, but which had utterly perished from the earth in following waves of barbarism succeeded again by interims of civilization.

To come to comparatively modern times, we know that Egypt had a magnificent civilization that perished. That Assyria and Babylon followed in the same path, meeting the same fate. That Greece built up a civilization of the highest intellectual character, unexcelled, if equalled today in literature and arts; that Rome followed with a glory that faded from the face of the earth. And now we have seen Germany rise to a material development almost unequalled but to become crushed to earth through the very materiality of her power. And what security have *we* that *our* civilization will not vanish as others have?

Is it likely that the great Assyrian, Babylonian or Egyptian civilizations, as in their zenith of power they overlooked their Enginneering works, unxecelled in bulk ang magnitude today, or the lorldly citizen of Rome which "from her throne of beauty ruled the world," could have imagined any more than *we* can today, that such power and glory must vanish? And why *did they* fail? Surely permanent civilization is desirable and must ultimately be attained.

Has man been violating any *law* of living, the failure to observe which has brought about his downfall? It must inevitably be so, because any failure to reach and maintain the highest advancement *must* come through failure to comply with some essential formulæ or law.

What is law? The absolute, inevitable, unchangeable result that follows a certain definite cause. When Newton proclaimed the law of gravitation he of course brought into play no new forces. He defined the rule of operation in gravity that had always existed, just as Copernicus defined the law of operation of the solar system. Is there some great law of life the infraction of which has brought about these recurrent débâcles of civilizat?on.

As Engineers who assume the duty of adapating the great forces of nature to the use and convenience of man, is it no our task to find such a law if it exists and apply it in the accomplishment of work? To my mind, as an Engineer, there is such a law, it has been defined and the world is living in constant infraction of it. When Jesus Christ, who has been called the first Socialist, in his Sermon on the Mount gave to the world what has been called the "Golden Rule"—"Do unto others as ye would they should do unto you"—I believe a law of life was proclaimed as absolute, unchangeable and inevitable in its workings as is the law of gravitation or that which governs the movements of the heavenly bodies. We accept the principle in physics, "Action is equal to reaction in a contrary direction," apply it as a matter of course in our mechanics and the calculation of stresses, and it would not occur to us to do otherwise, why should we not recognize it as equally a matter of course in our social relationships?

The forces most menacing to peace and prosperity today, directly antagonistic to this "Golden Rule," are, on the part of *Capital*, the spirit which refuses to be content with a fair profit on investment, but resorts to extortion, which is called "profiteering"; on the part of Labor, the spirit of exacting the highest possible wage, regardless of the effect upon other classes and then of yielding the least possible return in measure of work for wages paid; and in all classes the spirit of "every man for himself and the devil take the hindmost." When through combinations in restraint of trade, the formation of trusts or other methods, a minority, composed of Capital, is able to control output of the necessities of life, and thereby exact from the mass of the people prices yielding extortionate profits; or when through Unions, Federations or Brotherhoods a minority composed of Labor, can control the output of transportation, fuel or other necessities of modern existence, in *either case*, the "life, liberty and pursuit of happiness" of the mass of the people is endangered, and sooner or later mankind must take adequate steps to control the situation and bring about fair play, or civilization must fail.

Unless and until the Capitalist, or the Captain of Industry in his dealings with Labor can meet and answer fairly the question, "If *I* were in that man's place. If I had lived and been raised in the same environment, with the same outlook upon life. If *I* had been denied the opportunities that have led to my present attainment, and had been forced to fight the losing fight, what would be my feelings under existing conditions as to what was right and just to *me*, and learn to act accordingly."

Until Labor in its dealings with Capital, with equal grace, can say: "If *I* had obtained wealth and success through my own efforts; if by tireless exertion and endless self-denial *I* had finally brought myself into a life of competence and power, what would be my feelings as to what is right and just under existing conditions, and learn to act accordingly."

Nay further, take the great middle class who have neither poverty nor riches, to which the great mass of mankind belong. Until we all can say, in our daily relationship with our fellow men, whether superior in rank or wealth, equal or subordinate, as to each one with whom we are thrown, "What would *I* feel was just and right if I had been raised in the same environment, met with the same reverses and successes, and led the same existence and *learn to act* accordingly?" Until that time can come, I say, the world must be filled with sorrow and contention, and the extent to which civilization will advance or recede, will be in direct proportion to the extent to which that law of life is followed by mankind. If Capital, obsessed with the power of wealth, grows in its exercise of autocracy, putting down under its feet the laboring classes, the fall of this civilization is just as sure and inevitable as was the extinction of the civilizations that have preceded this; and again, if Labor, drunk with its new found power obtained from organization, shall become class conscious, setting aside justice and fair dealing in its relationship with Capital and the great middle classes, assuming through its leaders autocratic powers and overriding the liberties of men, the fall of this civilization is equally certain, and from its ashes must arise finally that new race of men which will have the will and the power to truly practice liberty, equality and fraternity.

Gentlemen, what I have been advancing is not intended as a moral diatribe.

As an Engineer, I have been endeavoring by cold analysis to resolve the most potent and practical force that is at the disposal of the Engineer for the accomplishment of great works, and I arrive at the conclusion that it is the force of Good Will. The world is in desperate need of it today, and I believe that when that force is fully and fairly recognized and used as a means to an end, the world will see works of magnitude and beauty so far in advance of the works of today as to be beyond the present conception of man. If we make an honest effort to apply it in the work of our Society, we need have no fear as to what will be its history in usefulness, not only to ourselves and to our profession, but to our fellow citizens at large.

The Army and the Engineer

By Major General Leonard Wood, U. S. A.

Presented at the Annual Dinner of the Society, January 28, 1920.

IN colonial constructive work, the administrator, the sanitary engineer and the constructing engineer, seem to go together. They are rather of a Trinity.

In Cuba, when we took over the problem of creating a republic out of some two million odd people, the relics of a war-worn Spanish colony, absolutely without government, with everything in wretched condition, a long war, with great destruction having practically wrecked the Island, we had to turn to the engineer as our right-hand man.

We had to build roads, build and rebuild water systems, rebuild public buildings, put in piers, do harbor work, and beside the constructing engineer went the sanitary engineer. I saw a great deal of the work of your profession, work of the engineers in almost every line of effort. It was a great and a very helpful force. It was one of the main agencies in bringing that Island into its present condition. We built up and established something that may interest you—an independent Department of Public Works, with a Secretary of Public Works in charge, for we had a miniature republic. We had to do everything for the Cubans. We had to lay down the constitution and municipal law, write railroad laws, laws of commerce, banking, sanitation, schools, in fact, formulate everything needed under a republican form of government. There was a miniature cabinet in preparation for the President who was to come.

I have often wondered whether it would not be a good thing to have in this country an independent Department of Public Works, with some responsible person at its head.

There was a Secretary of Public Instruction, who was charged with the standardization and regulation of public instruction in the six states or provinces of the Island.

The Department of Public Works was an extremely useful one. With the Secretary of Public Works a definite system was worked out. Cuba was provided for under a very elaborate budget system twenty years ago. In fact, work in all departments was done under a fixed budget. I believe the success of an independent Department of Public Works with the Secretary of Public Works was such in that Island that it is well worth considering whether or not it would be advisable in the United States, with its enormous mass of public works to be done.

Your engineers did an enormous work in Cuba, and the constructing engineer, hand in hand with the sanitary engineer, were the forces which built the Panama Canal.

The canal was built on the foundation laid by the sanitary engineer. It was founded on the work done by Walter Reid in Cuba, who was the directing mind in discovering the means of transmitting yellow fever, and consequently controlling yellow fever.

General Ludlow, the distinguished engineer, had been Governor of Havana, and I had been Governor of the eastern end of the Island, in the days just after the war. The yellow fever came sweeping along, taking away in six weeks of one summer a third of my staff, and the next year, twenty-five percent in three weeks. The fever could not be checked. Then came Reid with his remarkable discovery, and Willimar, Lazear and Carroll laid down principles and lines of action which enabled us to wipe out yellow fever. The sanitary engineer came in and did an enormous amount of work in this connection, and on this foundation was built the Panama Canal. The French are quite as good engineers as we. They had a great deal of consideration to the plan, although they had not developed the idea of the Chagres Basin, controlling the floods. But they could not go on with the work because the death rate was so heavy. If you have ever lived in the tropics you have seen your friend at breakfast buried in the afternoon with Asiatic cholera, and the next day another friend will be buried with yellow fever.

The sanitary engineer laid the foundation of which men of your profession took advantage, and built the great Canal. It takes nothing from the honor of the constructing engineer to give due credit to the medical man and the sanitary engineer, who made that work possible.

In the Philippines, when government was being established in the Southern Islands, again it was necessary to call upon the engineer. Again he was the principal agency of the Colonial Administration in building bridges, etc.

In this country, before the war, some of us were trying to interest the people in preparedness. We built up the Engineers' Reserve Corps. Next to the Medical Reserve Corps it was the earliest of our Reserve Corps, and the way it was organized is rather interesting.

At that time I had command of the entire Atlantic Coast, Panama and Porto Rico, and it was necessary to lay out lines of defense around our great cities. Of course, those lines of defense cut through villages and destroyed many works of public utility. We did not build them in time of peace, but we had to mark them out and draw all the plans, so that we could turn them over to working forces of engineers.

It occurred to me, that we should have engineers subject to call in all of these cities. Why not have engineers in all cities who shall belong to the Reserve Corps,—the electrical, the hydraulic, the civil, the various types of engineers; why not have them in the Reserve Corps in their various localities? They were in Boston, New York and Portland, and if we had to build these defenses, what men were better fitted than the men who lived there, who knew the contractors, the resources of the cities, and the sources of supply? It impressed me as an opportunity to make immediate and valuable use of the engineer.

Two or three years before the war at a meeting of the Engineers' Club in New York City,—we had there the President of your Society, and the Secretaries of many others,—there was born the Engineers' Reserve Corps. It has been one of the most wonderful corps, and one which we should maintain. I hope that all of you gentlemen will do your utmost to aid us in keeping alive and strong the Engineers' Reserve Corps. Along our Atlantic Seaboard and along the Pacific Coast it would be of great value, in case of sudden emergency, to have your Reserve Engineers, in whose hands could be placed the plans of protection drawn in engineering language.

You know how tremendously valuable were the services of the engineer in the great war. There has never been a war in which the engineer and sanitarian played so large a part. Many of the undertakings were done underground. An enormous amount of destructive and constructive work had to be done; railroads built, ports of debarkation and embarkation were built, all the work of the engineer. And hand in hand with him went the sanitarian. We went through this war in most extraordinary fashion. Our men were healthy, living under conditions which meant certain death a few years ago, through the efforts of the sanitary engineer.

I have been particularly interested in the work of the Engineer, and I am especially interested in your building up and keeping alive in this country the Engineers' Reserve Corps. That is your big part in the scheme of national defense.

I want to suggest that you form an offensive and defensive alliance with the architects and try to evolve some general policy of construction in our great cities. We have sanitary regulations. The construction of public buildings and private residences is governed to a certain extent, but we have no regulations which prevent monstrosities of construction from being inflicted upon the public. A combination of the architects and engineers in a determined effort to secure utility and lines of beauty would be a decided benefit to any city. Our works of utility might just as well be works of beauty. Your engineers in Cuba were able to accomplish that object. I believe there is a great field for effort along that line in this country. I do not know of anything that is more helpful to young people than to see the right kind of construction on sound lines.

March 5, 1920

The Engineer—A Citizen

By Onward Bates, M. W. S E.,
Representing the American Society of Civil Engineers.

Presented February 28, 1920.

I THANK our Chairman for that delicate compliment about the age of members of the American Society of Civil Engineers. I am pretty nearly as old in the Western Society. I was in hope, that in the shuffle, these addresses by members of the national societies would get left out, but it seems not, and when I looked at the program, if it was not to use a very shop worn term, I would have said that putting them ahead of the real business of the evening was nothing but camouflage. However, there is something that can be said in this connection which does not directly affect our absent guest, Mr. Hoover. It may be said now.

We have here this evening an admirable illustration of comity between engineering societies. Within the last few years there has been much discussion on the subject of co-operation between engineering societies. Now what do we have here? The example of the Western Society of Engineers, which is responsible for this Washington Award, inviting the four national societies of engineers, the four leading societies I should say, to participate in the administration of the Washington Award, is a very fraternal and professional action on the part of the Western Society.

Speaking now for the American Society of Civil Engineers, which put me on this commission, I wish to thank the Western Society and to say that the privilege of taking part in this award to a distinguished engineer is greatly appreciated by the American Society, and it must feel that there is honor reflected upon it when its joins the Western Society in bestowing the highest honor which it can give.

I understand Mr. Hoover is a very modest man, but there is one thing about him which appeals to me more than anything else and I think it carries a great lesson to engineers. That is his citizenship. We have had many efforts to define the profession of engineering and what an engineer is, and it has not been done, not properly done; we only have a compilation of definitions that have been supplied by different people who thought they were capable of making such definitions. Let us look at the profession from the other end and see what an engineer does. It does not make much difference about the definition so long as the ultimate object is attained. For a long time I have had an idea that the ultimate object of the engineering profession, in all its branches, must be to do the most good for your fellow-man—and it seems almost Utopian —impossible—and yet, if we believe the half of what we read and hear about Mr. Hoover, he has established the possibility of high and unselfish service.

There is no use in engineers saying that we are restricted, that we do not get our deserts, and so on, because we have exactly the same standing in this Republic, at least, that all other citizens have, and to be citizens we must be such in every sense of the word. What does Herbert Hoover show us? He shows us that he is a citizen, first of all, an individual. He has done things, wonderful things, he has been a great organizer and administrator and yet he is not the product of organization. He made himself. It is his individuality which made him. We must not forget that, and get mixed up with the prevailing idea that organizations make the man. The man makes the organization. That will come out most prominently if we stop to think of it, and will account for Hoover's success. The lesson for us is better citizenship. Hoover has shown us this—that the citizenship of an engineer is like the practice of an engineer. It is cosmopolitan, it may go anywhere in the world, and just so his citizenship may become cosmopolitan. Hoover is a cosmopolitan citizen, a citizen of the world, and that is about the highest compliment I can pay him. That is my judgment.

The American Mining Engineer

By Charles H. MacDowell, M. W. S. E.,
Representing the American Institute of Mining and Metallurgical Engineers.

Presented February 28, 1920.

A COMPOSITE picture of the American mining engineer shows him to be a versatile individual with a working knowledge of many branches of engineering. He is not only versatile—he is adaptable—he is as much at home in some primitive, far-off, revolutionary country, with his hat for an office, as in a city skyscraper. As for the revolution, that is an old story to him. He is an authority on revolutions. He can throw a diamond hitch, cook his food, drive a mule or a tunnel, manage an Irish foreman, a sun-dodging Mexican or a Chinese coolie. He is an expert with the slide rule and with the can opener, and some ancient writer, possibly Agricola, has intimated that, in the "good old days," he understood the technique of the corkscrew. Like the country doctor, he can make an emergency repair with a jackknife, a piece of string, a scanting and the tail of a shirt. If supplied with the wherewithal, he can buy as much machinery in a given time as any war procurement agency. If funds are low, as is more often the case, he can extemporize and come as near making something out of nothing and make it work, as any agency in existence. He is facile in language, ranging from burro Anglo-Saxon to pigeon Spanish or Chinese. Indeed, he has occasionally been able to make himself partly understood by the French poilu. In American, he is almost able to explain to a layman the laws governing the apex or the theory of oil separation. When reasonably sure of his ground, he has been known to condense his report conclusions to a final seven pages, and so clearly that his client could understand enough to "come across." He indignantly refuses to simplify his spelling to conserve pigment and paper.

He generally makes money for his people; he at times amalgamates some unto himself. Usually his bonus compensation is the feeling he is doing some good in the world.

The mining engineer, like other engineers, is a real fellow—decisive, courageous, conclusive; doing a genuine work; ready to go anywhere, anytime, for a purpose; getting results if they are to be had.

The American mining engineer, with his varied talent for adapting himself, is also considerable of a cosmopolite. In the discharge of his duties, he travels in many lands, and is in vogue in many nations. He is, in fact, a migratory creature, and he shuttles back and forth freely as he weaves the golden web of mineral production.

Thus it happened that in the summer of 1914, one of these itinerant engineers, eminent in his profession, a chief and a leader, was in London, where his work then centered. Here his latch string hung out to colleagues and compatriots.

Meanwhile the Entente's diplomatic aereos, working with short wave lengths, failed to catch the message from Mars telling of the coming of "der Tag." They were unprepared—the crash came. A continent was upset—the people of an unoffensive nation were in dire distress. Something must be done at once, and with resourcefulness. The task was not for the diplomat, or the procrastinator, but for the doer. As has happened before in serious crises, the man was found. He was in London—he was our mining engineer—a typical functioning American—an organizer—an inspirer of confidence. His colleagues flocked to his banner. So did the people. How well this man and his colleagues bore out the traditions of their profession—how he and they grew as responsibilities pyramided, is known to all people—and is a part of permanent history.

Far be it from us to arrogate unto the mining engineers special credit for Mr. Hoover's accomplishments. We feel that the character, education, training, resourcefulness, mental discipline and travel, common to all engineers, prepared him for his work—a work which has laid bare to the engineer the value of returns from unselfish work in making the world a better, healthier and happier place of abode as the procession moves on.

The members of the American Institute of Mining and Metallurgical Engineers are more than proud of their President and his achievements. The bestowal of the Washington Award on Herbert Clark Hoover gratifies them beyond measure of expression.

Service and Inspiration

By J. Rowland Bibbins, M. W. S. E.
Representing the American Society of Mechanical Engineers.

Presented February 28, 1920.

IT is indeed an honor to be asked to represent one of the four great Founder Societies by the two members of the Washington Award Commission, Dean Mortimer E. Cooley and Mr. Charles W. Baker, who are unable to be present on this auspicious occasion.

If I were so fortunate as to be able to sound the keynote of the social activities of the American Society of Mechanical Engineers, I should say that all was compounded into one word—a word that permeates every line of the program before you this evening—Service. I look upon Service—the spirit as well as the deed—as one of the great ideals of the profession and the members of the American Society of Mechanical Engineers, it seems to me, in their highest attainments have been filled with the spirit of Service in their chosen field—the great field of Industry. Therefore, I am especially pleased that Mr. Hoover has directed your attention to the importance of those great questions of Industry. They are, as it were, bonded together in a sincere effort to solve its problems.

Is not Service the true inspiration of all mankind? Long years ago Francis Bacon gave this very lucid description of what a man owes to his profession:

> "I hold every man a debtor to his profession, from which, men, of course, do seek to receive contenance and profit, so ought they, of duty, to endeavor themselves, by way of amends, to be an help and ornament thereto."

I think you sense the application of that quotation in the perception and practical helpfulness of Mr. Hoover's message. So has the American Society of Mechanical Engineers, it seems to me, endeavored to lay the foundations of and to perpetuate a stable industrial structure—that structure which has been reared out of Science and Reason by the minds and heart—yes, and the life-blood—of men.

For what is Engineering but the synthesis of Science and Reason; what is Science but the growing consciousness of man—the revelation of the Divine laws of Nature? And do we violate Reason in any way by entertaining the hope the man's knowledge is given to him on the sufferance of the Creator?

A short time ago the eminent English physicist, Sir Oliver Lodge, gave out a statement that stirs one's imagination to its profoundest depths. He spoke of "Scapa Flow"—that if the atomic energy of an ounce of matter could be completely utilized it would furnish sufficient power to raise the sunken German battleships from their bed in Scapa Flow and pile them high on the Scottish Mountains; but he fervently hoped that man would not be able to discover the secret of that awful power until he had the brains and morality—made himself worthy to use it properly. What vision his in that conception of man's existence?

Have we not, therefore, a right to have pride in our profession, especially in the advances that have been made in economic and humanitarian studies? Compare the vocabulary of the old days of misunderstanding—historians will label "the Era of Strife between Capital and Labor," with the enlightened and inspiring new era of today, with its new terms—"democracy," "human engineering," "economic research." Ought we not to characterize the Engineer as well as the Scientist as a man consecrated to search for the Truth and should we fear that that search will not ultimately divise the solution of the temporal problems of Industry, however hopeless those problems may seem in these troubled, hysterical moments? The American Society of Mechanical Engineers has set its face towards Research as the key to industrial unrest. This fact appears throughout all the records of the deliberations of the Society.

Right here, for the first time in history, the engineer contacts with public affairs. For the problems of Industry are nation-wide. And here, again, is the Engineer's supreme opportunity for service. Few have embraced this opportunity as fully as Herbert Hoover—and few indeed have been crowned by such success. But it does not dim the brilliancy of the achievements of Herbert Hoover, the man we honor, for the American Society of Mechanical Engineers and the Societies represented in this Award to share our felicitations with him. They recognize work well done. They recognize service conceived in the true spirit of a search for the Truth. They are happy in recognizing service rendered in a manner befitting the ideals of the great profession which honors him and is honored by him.

Recognition of the Engineer

By Bion J. Arnold, M. W. S. E.

Representing the American Institute of Electrical Engineers.

Presented February 28, 1920.

I HAVE the honor tonight to represent, as President Copeland has stated, the youngest of the five national engineering societies, the American Institute of Electrical Engineers. That institution about 16 years ago was the first to promote the idea of branch societies of the national engineering institutions. The idea started during President Scott's administration in 1904. It was his particular idea, that while the national societies at that time were doing a good work, they could do a much better work if the advantages of the societies could be placed before a greater number of the membership each month or at regular and more frequent intervals. At that time the headquarters of all of the societies, except the Western Society, were in New York. The American Institute was the first of the societies to put that idea into effect. It chanced to fall upon my administration—I having succeeded President Scott—to organize and carry out the plan. It worked. The other national societies followed, the Civil, the Mechanical, and the Mining Engineers, and it has resulted in bringing the engineers of the country into much closer contact with their national organizations and also in broadening those same engineers by giving them a more frequent opportunity to get acquainted with each other and to discuss the subjects that were formerly discussed before the national gathering in New York once a year. That, in my judgment, was one of the most important steps that the national societies took to place the engineering profession in position to begin to be as influential as it desired to be, or as the members desired to be in the communities in which they lived. We hear ourselves saying that our work is not understood by the community. Therefore, we are apt to think that the engineer's work is not appreciated. It has been my observation for years that the engineer will be appreciated and engineering bodies will be appreciated, in proportion as they make themselves known, and assist the communities in which they exist. In other words, it is this same idea of service that has been emphasized by our Chairman, by Mr. Bibbins and others this evening, and I maintain that if the engineer or if the bodies of engineers will give to the community something which the community needs, then, as individuals and as bodies they will get full recognition of their abilities and their effects. In talking with Mr. Alvord, the founder of the Washington Award, I learned from him that his original conception was that this award should establish a prize or mode of recognition, to be given to engineers who were doing loyal and faithful work in the back rooms of our offices and our City Halls, where they were perhaps not appreciated, and where criticism was directed toward them and usually undeserved. There are many good engineers in our municipal organizations and in the commercial organizations that are doing splendid work that you never hear of, because their work is of such a character that it does not come before the public. It was the idea of Mr. Alvord to give those men a chance to be recognized by a committee of their associates who would pick them out for deserved recognition and grant them this award from year to year. I still think it should apply in such cases when deserved, but I think he was wise, after consultation with his associates, to broaden the field to which they expected to apply the award.

We established, on February 11, 1904, at a banquet in the Waldorf-Astoria Hotel in New York City, a medal in the name of Edison, known as the Edison Medal. The American Institute of Electrical Engineers was instrumental in the organization of that plan, although it was financed by individuals, connected with the leading electrical industries of the country. They made the donation, but it was left to the American Institute of Electrical Engineers to conduct the function at which the medal was awarded and to formulate a plan for its annual award. It happened to be my good fortune to preside that evening because I was then the President of the Institute. When we established that medal and created the rules and methods for distributing it, we at first limited its award to graduates of technical educational institutions of the United States who delivered the best thesis upon some electrical engineering subject. Later, after conference with others, we decided that there was to be no limit to the field from which candidates for that medal might come. In other words, we were to pick out the man, anywhere in the world, who had done the most for electrical science during the preceding year. We awarded the first medal to Lord Kelvin, a man who stood at the top of his profession, and, in like manner, this medal is first going to a man who ranks among the highest, in my judgment, although in a different field from that of Lord Kelvin. I think the two medals have happily come out along the same channels, the field having been broadened in each instance. On behalf of the American Institute of Electrical Engineers and representing its members on the Awarding Committee, I take pleasure in concurring with the award, which I believe has been so well placed and in honoring Mr. Hoover.

ERRATA:—Volume XXV, No. 5, Page 168, Line 31, substitute "*Elihu Thomson*" for "*Lord Kelvin*"

Presentation of the Washington Award to Herbert Clark Hoover

By Charles F. Loweth,
Chairman, Washington Award Commission.
Representing the Western Society of Engineers.

Presented February 28, 1920.

THE Washington Award is a recognition of public service by a professional engineer. The rule governing the Washington Award Commission in conferring an award is taken from the letter of the founder in transmitting his gift to the Board of Direction of the Western Society of Engineers. In this letter he desired that the recipient be: "A member of the engineering profession who has accomplished much for the world about him in vital, important, far-reaching ways, and whose services in general have been noteworthy for merit in promoting the public welfare."

An award given to a professional engineer, in recognition of notable public service, may fittingly be called a Washington Award in commemoration of the young engineer and surveyor, who by virtue of devoted service to his country, won the undying love of his countrymen, and who is honored throughout the years as the "First American" and the "Father of His Country."

With fidelity to the letter and spirit of the wish of the founder, the Washington Award Commission in December of 1918 decided that the first presentation of the Washington Award should be to Mr. Herbert Clark Hoover, a professional engineer and American citizen, for distinguished service to his country, to Belgium, and to the world at large in the conception, organization and administration of the Commission for Relief in Belgium.

There is no need at this time to dwell on the circumstances which, in that fateful month of August, 1914, found the peaceful and prosperous peoples of Belgium at war. The world knows that story and will not soon forget. All honor to Belgium that of the alternatives for her choice she chose war, though while honor called her men to the army, it left the old men and women and children exposed to the horrors of ruthless warfare.

Quick to sense the desperate need of relief for this situation, a small group of true Americans near at hand, strangers in a strange land, their own plans much awry, quickly organized temporary relief. Well for the world that they were there and to the everlasting credit of America. Chief of this little group was Mr. Hoover. He it was who rallied the little handful into an effective working force, which with calmness and good judgment gave guidance, help and comfort to hundreds of their fellow-countrymen and women, caught in the suddenness of the German attack, and stranded in unexpected and perplexing ways. Out of this hastily organized band of devoted men, and almost over-night, was built up the Commission for Relief in Belgium. At its head, organizing, guiding, inspiring, was Mr. Hoover.

The call for help for needy Belgium which Mr. Hoover sent to his fellow-countrymen at home was an appeal and a challenge. That the American people responded so promptly and generously was in no small degree due to their confidence in the man and in his ability to administer faithfully and effectively the trust they so willingly bestowed on him and the great responsibility he so promptly and modestly accepted.

The gathering of relief supplies in America was but a small beginning of the great task. Never before had ships been so hard to get, nor their paths so strewn with dangers. To land the supplies in Belgium and transport them to the districts where needed was a task continually beset with difficulties and dangers, and there remained the yet more difficult one of distributing the food and clothing to the women and children in the war-stricken areas. There were no agencies for transportation and distribution except such as Mr. Hoover and his aids could themselves arrange. Friendly military forces had little time to give assistance, indeed, must often obstruct the work, since military secrets must be guarded and battles must be fought even if women and children starve in the meanwhile; and lastly, at every point a ruthless and brutal enemy must be contended with.

But opposed to all difficulties was the earnestness, tactfulness, the quiet but indomitable courage of the great organizing and administrative skill and the zeal and practical sympathy of Mr. Hoover which made it possible for the Commission for Relief to measureably meet the needs of the situation.

It is fitting that reference be made here to the splendid personnel of the organization built up by Mr. Hoover for this great work. His associates were prompt to volunteer for service, they worked untiringly day and night, exposed always to hardships and dangers. They sacrificed personal interests and played the part of good Samaritans under difficult conditions. "Hoover's food men," as they were frequently called, went wherever there was suffering and need. So prompt was the relief they carried that ofttimes they traversed the war-swept areas simultaneously with the horsemen of war, pestilence and death. To many thousands of helpless, starving people they were truly messengers of Christ.

That such an efficient and self-sacrificing organization was built up under war conditions is a tribute to the qualities of their leader, whose skill and courage were equal to all emergencies, whose energy was unflagging, whose sympathy and zeal were an inspiration to service. Never before had there been a finer example of organized, practical and sympathetic relief for human distress than was this Commission. Read it where you will, always and everywhere, the record of this great welfare work shows that Mr. Hoover, calm, courageous, with modesty and dignity, represented the highest type of American citizenship.

As the war dragged through the weary years, desolating larger and larger areas, bringing to the point of starvation a rapidly increasing number of the populations of several countries, the need for succor and relief grew apace. From the Commission for Relief in Belgium, so hastily but effectively thrown together out of hand to meet an emergency, were moulded the United States Food Administration and the American Relief Administration. These were, and continue to be, the larger agencies through which the American people have extended practical aid and sympathy to the many suffering peoples of Europe. The direction and administration of these agencies were entrusted to the same guiding mind as had so successfully directed the work of the Commission for Relief in Belgium.

In addition, Mr. Hoover has been Director General of Allied Relief, Chairman of Food Section of the Supreme Economic Council of the Peace Conference, and later, Chairman of the Supreme Economic Council, Member of the War Trade Council, and has held positions of similar responsibility and trust in many other relief activities. To the demands of all these responsibilities he has responded promptly and heartily, rendering service for worldwide welfare which has been of incalculable value, endearing his name, and reflecting credit on his countrymen in the hearts of many millions throughout the world.

And so the measure of the public service of this fellow engineer whom we delight to honor on this occasion, has greatly multiplied, during the more than a year since the Washington Award Commission, representing over 40,000 professional Engineers, chose Mr. Herbert Clark Hoover as the one engineer who, more than all others within their ken, had measured up to the spirit of the conditions of the Award, and rendered important, far-reaching and distinguished service in promoting public welfare. It has been on account of this extended and continuing service that the earlier presentation of this award has been impossible.

And now, Mr. Hoover, the Washington Award Commission, representing the American Society of Civil Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, and that other great national engineering society which has so recently honored itself in electing you as its President, the American Institute of Mining and Metallurgical Engineers, and the Western Society of Engineers, to which is entrusted the administration of this Washington Award, presents to you this certificate of the first of Washington Awards of Honor and Merit for abundant and distinquished service in promoting the public welfare.

And this, sir, is the token of the award. We wish that it were of gold instead of bronze so that it might the more adequately represent the appreciation we have of the very high service that you have rendered to your country and to the world.

Washington Award Dinner

Saturday Evening, February 28, 1920.

THIS was a dinner meeting of the Western Society of Engineers to present to Herbert Clark Hoover the Washington Award of the Society for "pre-eminent services in promoting the public welfare."

The commission administering the award is composed of representatives of the Western Society of Engineers, the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Members of the above named national societies were in attendance at the dinner.

There were six hundred present.

After dinner the meeting was called to order by Mr. Frederick K. Copeland, President Western Society of Engineers, acting as toastmaster.

Mr. Copeland: Those who are not members of the Western Society possibly are not familiar with the purposes of the Washington Award. The Western Society has had friends and members in the past who have taken such an interest in it and its activities that they have given the Society funds for various uses.

The first of these was the Octave Chanute Fund, from the proceeds of which the Society, from time to time, has given medals to members who have presented the best papers during the year on either Civil, Mechanical or Electrical Engineering subjects. At the 1920 Annual Dinner announcement was made of the Robert W. Hunt Fund, given to the Society for the purpose of stimulating interest among its younger members in iron and steel and its fabrication—a fund of five thousand dollars—which will be used to interest and stimulate young engineers.

In 1916 another fund was given to the Society by an engineer who stands at the head of his profession, not only in Chicago but in the country as a whole, and in order to give you an understanding of the breadth of this man's vision, of what he hoped to accomplish, I will read the letter that accompanied this gift. It is addressed to the President and Board of Direction of the Western Society of Engineers.

> "It has long been my observation that there are numerous instances where the engineer serves the public amid many difficulties and often in inconspicuous ways, but with such ability that he accomplishes some particularly valuable results for the benefit of the community. Such achievements are often only known and not always properly acknowledged even by the profession to which he belongs, and they not infrequently entirely escape public notice.
>
> "Further, it is well known that great benefits often accrue to the public at large through valuable improvements in the arts

and their adaptation to the public use and need, and that these improvements are at times given by engineers to the public use without personal reward or gain.

"Finally, there is a class of engineers, who, although substantially rewarded in a material way by the success of their work, nevertheless have accomplished so much for the world about them in vital, important and far-reaching ways, that they are deserving further of special honor for their accomplishments.

"It is not always clearly perceived that almost all engineers serve the public directly or indirectly and the field for useful public service is therefore about as wide as the profession, and it would appear that it is one of the important duties of engineering societies to point out to their membership and to the public such instances of engineering and administrative skill as seem to have unusual merit, in order that honor may be properly accorded where it is due.

"Being desirous of promoting a better appreciation by the public of able work accomplished by engineers for the public welfare, and, further, of encouraging among engineers themselves a broader understanding of their opportunities for public usefulness, I desire to see established by the Western Society of Engineers an honor award—by medal or other tribute—to be annually presented to that engineer whose particular work in some special instance or whose services in general have been noteworthy for their merit in promoting the public good.

"I should be pleased if the recipient of such honor be not limited by Western Society membership, or in fact be restricted by any society or locality requirement. The only qualifications suggested are that he be an engineer of some reasonable degree of professional skill or administrative attainment. It would appear that the award will serve its purpose wisely if at times it is worthily bestowed upon comparatively little known instances of public and professional devotion, as well as at other times upon more conspicuous services."

This donor is a man who has given most generously of his time to public benefits. He has never been called upon for public service that he has not responded, and, as a member of the Western Society, I want to suggest that we all express to Mr. John Watson Alvord our appreciation, not only of his generosity but of the wise and intelligent suggestion that he makes as to the uses of this award.

The Western Society appointed a committee to take charge of this award and this is the first time that the Society has been called together when a recipient has been chosen. The period of the war so involved the engineering profession that it was impossible to get earlier action. The Commission decided to give this award the name of the Washington Award. It is probably not necessary to tell you why, but for some of the ignorant who may not know that George Washington was among our first and best known engineers, that I will say is the reason for it, and the period or date of this meeting was fixed for the third week in February, following as closely as possible the date of Washington's birthday.

Now that we have the Western Society members together, I want to emphasize again the fact that no society is bigger or stronger or more valuable than its members. Its officers, its directors and its committees can only go so far as they are backed up by the membership. They can only make a few suggestions. They want help. They want the enthusiasm of the membership. They want the younger men and the older men, too, to feel that the Society is theirs, that the meetings which are held from time to time are theirs, that they are afforded opportunity to get together and interchange scientific ideas as well as cultivate the pleasant social relation that comes from meetings of that character.

We are starting out this year with a large new membership, to a certain extent undigested at this time, and I ask the older men, the men who have been members of the Society for years, to help the younger men become active, to urge them to attend the meetings, and to impress upon them the advantages that come to younger men, particularly from association with older and wiser men. It is the intention of the Board of Directors to assist the younger men to become more active in society affairs so that as time goes on this organization of three thousand or more members may double in strength and size, and double and treble in its value to the community.

As this is a Hoover evening, we are fortunate in having with us tonight a man who has been associated with Mr. Hoover and his work in Washington, and he has kindly offered to tell us something about him—Mr. John T. Richards.

Mr. Richards: I have, in days gone by, found it necessary, occasionally, to associate with an engineer, but I believe this is the first time in my life that I have been confronted with such an array of engineering talent.

It is true that I came in contact with Mr. Hoover quite frequently during the late war. I had occasion to confer with him, and to attend meetings in Washington where he had called together the counsel and representatives of the Food Administration in the 48 states of this Union. When, on the 10th of August, 1917, Mr. Hoover was named as United States Food Administrator, he was given a free hand to organize that Administration as he might deem best. He had but recently returned to this country from his wonderful experiences in Belgium, where he had done a most marvelous work, one which the world will always look upon and recognize as little less than herculean in the task which he had undertaken. He accomplished those splendid results there, and when he came back and was appointed by the President to take charge, at the breaking out of war, of the administration of food supplies, he organized that wonderful department of the government known as the United States Food Administration. Whatever may be said of any other department of the government, it can be truthfully said that so far as that department was concerned there never was any politics in it. He knew only efficiency. He recognized only efficiency in the work of the department to which he was assigned. I suppose that was due to the fact that he was an engineer. I have always understood that engineers are very efficient.

But I want to say a few things about Mr. Hoover personally, about his personality and his methods. He is one of the most charming men, personally, with whom it has ever been my good fortune to come in contact. I saw him on more than one occasion presiding at a meeting where there were perhaps ninety or more men present; he would call upon this one and upon that one and upon another one, men from all over the Union, to express their views as to what could be said upon any particular branch of the work of the Food Administration. He would, when they had concluded their statement, propound to them questions—that was his method—"What do you say as to this proposition?" "What would you advise should be done in relation to this matter, and the other?" And so on; he made notes of all those answers. He indicated upon a little memorandum tablet the views of every one whose views were expressed, and then after he had gathered those together, he put the memoranda in his pocket. He made no reply. He indicated in no way what his conclusion would be, but when the time came he took all those things into consideration and then announced his decision. That was his method of conducting the department.

The work of the Food Administration was most marvelous. Few people have any comprehension of the tremendous work which he did in its organization, selecting the men whom he believed, in each state, would best carry on the work of the department. He left it to those men to select their assistants, never interfering with the rank and file of the department. He was always modest and retiring. You must recognize the fact that he is in no degree a self-centered man, but a man whose eyes and ears are always open to gather the very best information that he can. He is a man of the highest sense of honor. I do not believe he has any political ambition. He believes that the duties of his profession are sufficient for him, and he does not require any outside influence to add to his present world-wide fame. I do not believe that any honor that could be bestowed upon Herbert Hoover could add to the renown which he possesses today. I look upon him as the most efficient administrator with whom I have ever come in contact, and I believe that he is so recognized, not only throughout the United States, but everywhere. He is one of the most lovable of men and one of our choicest citizens.

No man is entitled to greater respect from his fellow citizens than is Herbert Clark Hoover.

Mr. Copeland: Mr. Frederic P. Vose, toastmaster at our last Annual Dinner, has consented to address a few remarks to us.

Mr. Vose: It is a splendid thing that on this occasion and within this hallowed month of February there should be presented by this Society to this remarkable engineer this beautiful token of esteem of him as a leader in his profession, a thing that will be borne with honor by him throughout his life. I am glad that this Society has unanimously endorsed the candidate for the highest office of the land.

At the table at which I was privileged to "set" tonight, it was suggested that this engineering society be increased even beyond this three thousand limit that you have attained—and hearty congratulations upon that attainment—but you might include the dentists, particularly those engaged in bridge work. I am willing to admit that as a toastmaster I am unique—from the Latin, "Unis" meaning one, and "equus" meaning horse.

Your program, auspiciously launched, well planned and printed, and in the course of fulfillment, is composed of men of solid weight, who will deliver the goods that is intended of them. It is always a pleasure when good fellows get together to hear straight-forward statements, straight from the shoulder, right to the eye. There are two kinds of speakers, the forthright speaker and the mere orator. The forthright speaker says: "Ladies and Gentlemen: I conclude my address of the evening with this simple problem which I will leave with you—two and two make four. I thank you."

Not so the orator. "My friends: Way back in the dim past, in old India, and then from there transmitted to Arabia, there arose a clever science, predicated upon the base of ten digits, and, my friends, if you take a digit of the first degree and add it to a digit of equal degree, the combination is a happy one of a digit of the second degree, and by a marvelous manipulation and reincantation of those syllables you have the digits of the second degree in combination with like digits of the second degree forming an answer and a culmination of a digit of the fourth degree. I thank you."

Mr. Copeland: The Western Society has a poet. He has written a poem for this occasion—Mr. James Noble Hatch—and Mr. Hatch will read his poem.

Mr. Hatch: Mr. Vose has placed you in a frame of mind to receive what I shall now give you.

Washington Award

Just a little hand-wrought token
    Moulded out in simple line,
With a value scarce bespoken
    By the modest, prim design,
Just some plain, clear-cut inscriptions
    In the metal neatly scored,—
That might be a fair description
    Of the Washington Award.

But how little of the meaning
    Which that emblem really holds
Would be found by simply gleaning
    What the tablature enfolds,

For the fervent thought behind it
And the brother love outpoured
Gives the worth that is assigned it;
Is the Washington Award.

Worthy deeds pass undetected
Few there be who think of them,
And the hero's oft neglected
Till they've sung his requiem;
So to better this condition
Which we all have long deplored,
Has appeared the splendid vision
Of the Washington Award.

And as outlined in this vision
With the Golden Rule in mind,
There has now been made provision
In a plan that's well defined,
For the giving of a token
That will worthily record
Deeds that Fame had left unspoken;
In the Washington Award.

And the noble, high endeavor
That has made these dreams come true,
Will be known and lauded ever
Long as men good deeds shall do;
And enblazoned on the pages
Of the future, John Alvord
Will be linked up through the ages
With the Washington Award.

Mr. Copeland: I know all feel tremendously disappointed that Mr. Hoover is not with us for the whole evening. I appreciate very much the way in which you are taking this dissapointment. I do not want to have anyone here under any misapprehension of the exact situation. The chances are that Mr. Hoover will not be here before 11 o'clock. We have received a telegram from Mr. Hoover, stating that his speech had been released to a press association in New York and had been telegraphed to one of the Chicago papers. We have the speech here, and our Past President, Mr. Baldwin, will read this, because with Mr. Hoover arriving late, we can only hope to have a short talk from him and have the pleasure of meeting him, whom we know is one of the greatest men the age has produced.

Mr. Baldwin: I am quite sure that none of you can feel more sincerely disappointed that extracts of Mr. Hoover's speech should be read in part to you rather than delivered, than I do myself. I, at least, have the advantage of a young Scotch minister who had been, on the occasion of his first sermon, very desirous of knowing the opinion of an old lady member of the congregation quite distinguished as a "sermon taster." After the sermon was over he gave her several opportunities to speak, but she failed to avail herself of these, and finally approaching her, he said: "Alice, tell me, what did you think of my sermon?" She hesitated a few moments and finally said: "A—weil, firstly you read your sermon; and secondly, you did-na read it well, and thirdly, it was-na worth reading at all." You may criticize me for the "firstly" and the "secondly," but I have no fear of criticism that these extracts are not worth reading at all.

(Mr. Baldwin read extracts from Mr. Hoover's address as printed in a daily paper.)

Mr. Copeland: I think everybody who hears or reads the speeches by Mr. Hoover cannot fail to be impressed by the soundness, the judgment, the wisdom an dthe broad vision which this man has and brings to bear on all the problems that he takes under his consideration.

The Commission of the Western Society that assumed charge of the Award by Mr. Alvord decided to bring into the Commission on the Award the four Founder Societies. The Western Society is second to but one engineering society in this country in age. The oldest is the American Society of Civil Engineers. Tonight a member of this Commission, a man chosen by the American Society of Civil Engineers to determine the recipient of this award, is present. He needs no introduction to the members of the Western Society, a Past President, a man who stands at the head of his profession, a man who has grown gray in the service, not only of the profession, but of the community, a man that we all honor and love, Mr. Onward Bates. I ask Mr. Onward Bates to speak to us at this time.

(Mr. Bates' address will be found on page 162 of this Journal.)

Mr. Copeland: Mr. Charles H. MacDowell, a member of this Commission will address us as a representative of the American Institute of Mining and Metallurgical Engineers, of which organization Mr. Hoover is President.

(Mr. MacDowell's address will be found on page 163 of this Journal.)

Mr. Copeland: The American Society of Mechanical Engineers was asked to take part in the determination of the Washington Award. Their representative, a valued member of the Western Society, one who has done valuable and interesting work as an engineer, will speak to us from the point of view of the Mechanical Engineer, Mr. James R. Bibbins.

(Mr. Bibbins' address will be found on page 165 of this Journal.)

Mr. Copeland: Another society of engineers, perhaps one of the most progressive of all, which has taken part in the Washington Award, is represented tonight by a man whose name is nation wide. Perhaps it is world wide. He gave up his professional work, sacrificed his own interests, to help solve some of the most important problems of the war. He was called to Washington in the first instance to assist in the training of Reserve Officers, first as engineers, and second as officers for the Expeditionary Force. Having served in that way, he later became a member of the Naval Consulting Board which passed on inventions for war purposes. After that he was transferred to the production department of the air service. He received a commission as Colonel in the Army for this service. Mr. Bion J. Arnold will address us as a representative of the American Institute of Electrical Engineers.

(Mr. Arnold's address will be found on page 167 of this Journal.)

(Mr. Hoover arrived at eleven forty-five.)

Mr. Copeland: Mr. Hoover, we are more than pleased to have you here. We appreciate what a disappointment it has been to you to have been detained; our disappointment has been as nothing. Now that you are here, we extend to you the most cordial greetings from the Western Society of Engineers. This moment has come that we have been waiting for when the Society through its representative can present to you this token. Mr. Loweth, the Chairman of the Commission, will make the presentation.

(Mr. Loweth's address will be found on page 169 of this Journal.)

Mr. Hoover: I feel a great deal of humiliation in appearing before an audience at so late an hour, more especially at such an event. I do apologize, but I do not apologize for government ownership of railroads.

I am indeed grateful for this tribute from the Western Society of Engineers, and from so large a body of associated engineers. I have always felt my life-long that the best test of a man's standing in the community is the esteem with which he is held by his fellow professional men. And, it is indeed a great tribute. I could not accept it for myself, because in these organizations, where I have had the honor to preside, there has been a large preponderance of engineers, volunteers from our own American profession, first in the Belgian Relief, then in the Food Administration; then again under the Supreme Economic Counsel I have had associated with me, first and last, over one thousand American engineers. It has been the ability of those men, their capacity and constructive thought, that quality of engineers which leads them to quantitative and not to qualitative thought, which has been the basis upon which organization in emergency has succeeded. Therefore, I could only accept this tribute as a trustee, on behalf of all those engineers who have made a greater sacrifice, perhaps, than myself in the service of humanity as a whole.

(Mr. Hoover's address will be found on page 145 of this Journal.)

Mr. Copeland: Mr. Hoover, in behalf of the Western Society we thank you for taking this long trip to be with us and to give us this wise understanding of this great problem of food and transportation. We need just this type of education, this type of inspiration; it is the men who think on these broad lines that are going to bring us out of our present difficulties and troubles.

Many things have been said about Mr. Hoover, one of which I think has not been touched upon. That is his ability, the power that he showed (with the immense powers that were given him as Food Administrator) in bringing this great country of ours to back him up in the saving of food in order that other nations might survive. In a wonderful way the people of America, who have been accustomed to luxury, to comfort, to freedom of purchase, denied themselves all these things, through the example and the request and the inspiration of our guest. To me, that is one of the most remarkable things that Mr. Hoover has accomplished. We have followed him in that. We have followed him through all his great enterprises, and if greater enterprises and greater opportunities still come before him, I feel that the engineers of the United States and the members of the Western Society of Engineers will still follow him.

Generator room of one of the hydro-electric plants which supply power to the C. M & St. P.

Some Advantages of Railroad Electrification

- Saving the Nation's coal.
- Lower maintenance costs.
- Greater reliability and fewer delays.
- Ability to haul smoothly heavier trains at higher speed.
- Operation of electric locomotives unaffected by extreme cold.
- Ability to brake trains on descending grades by returning power to the trolley.

The Power of Electricity in Transportation

ELECTRICITY has leveled out the Continental Divide.

On the Chicago, Milwaukee & St. Paul Railway—the world's greatest electrification—giant electric locomotives have thoroughly outclassed their steam rival. Utilizing the abundant energy of distant waterfalls, they lift an ever increasing freight tonnage over the mile-high Rockies and also make traveling clean and comfortable. And their capabilities are not impaired by weather so cold that the steam engine becomes frozen and helpless.

Electric power drives the trains of New York City's subway and elevated systems. It operates the locks and tows the ships through the Panama Canal. It propels the Navy's latest super-dreadnaught, the *New Mexico*. Electric locomotives have replaced the slow-moving mule and the electric automobile has also come to do an important service.

Electricity has contributed efficiency and comfort to every form of transportation, and in this evolution General Electric apparatus has played a large part—from mighty electric locomotives to tiny lamps for the automobile.

General Electric Company

General Office
Schenectady, N.Y.

Sales Offices in
all large cities

THE ENGINEER

(Sung to the tune of "Son of Gambolier")

Who is the man designs our pumps with judgment, skill and care?
Who is the man that builds 'em and who keeps them in repair?
Who has to shut them down because the valve seats disappear?
The bearing-wearing, gearing-tearing mechanical engineer:

Who buys his juice for half a cent and wants to charge a dime?
Who when we've signed the contract can't deliver half the time?
Who thinks a loss of twenty-six per cent is nothing queer?
The volt-inducing, load-reducing electrical engineer:

Who is it takes a transit out to find a sewer to tap?
Who then with care extreme locates the junction on the map?
Who is it goes to dig it up and finds it nowhere near?
The mud-bespattered, torn and tattered civil engineer:

Who thinks without his products we would all be in the lurch?
Who has a heathen idol which he designates Research?
Who tints the creeks, perfumes the air, and makes the landscapes drear?
The stink-evolving, grass-dissolving chemical engineer:

Who is the man who'll draw a plan for everything you desire?
From a trans-Atlantic liner to a hairpin made of wire?
With "ifs" and "ands," "howe'ers" and "buts" who makes his meaning clear?
The work-disdaining, fee-retaining consulting engineer:

Who builds a road for fifty years that disappears in two?
Then changes his identity, so no one's left to sue?
Who covers all the traveled roads with filthy oily smear?
The bump-providing, rough-on-riding highway engineer:

Who takes the pleasure out of life and makes existence hell?
Who'll fire a real good-looking one because she cannot spell?
Who substitutes a dictaphone for coral-tinted ear?
The penny-chasing, dollar-wasting efficiency engineer.

CURRENT NEWS SECTION

JOURNAL OF THE WESTERN SOCIETY OF ENGINEERS

Volume XXV MARCH 20, 1920 Number 6

Mr. Insull's address in full will be printed in a later number of the *Journal.*

NOON LUNCHEON SUCCESS

Insull Makes Address Applicable to W. S. E. Members

"The engineer many, many times shrinks from his responsibilities, especially when it is his duty to give attention to affairs of moment to the community or state in which he lives," said Samuel Insull at the first noon luncheon of the Western Society in the Hotel Morrison April 2.

"It is the duty of your engineering profession to become better acquainted with the lay problems of the day and at times forget a little of your knowledge of the slide rule and drawing board. Nothing can be more appropriate or fitting than these luncheons which you are planning to hold each month. By means of these informal gatherings you are building a foundation for meritorious public service."

Mr. Insull's subject was "The Engineer's Influence in Public Utilities." As head of the Commonwealth Edison Company and the Peoples' Gas Light and Coke Company, he is one of the most prominent men in the United States connected with the growth of public utilities.

In local or state government, politicians make enormous claims which cannot be substantiated, he added, in the interests of some project which they are pushing. It is for the engineer, with his keen foresight, education and knowledge to present the facts concerning the question in hand.

It is the duty of citizenship of every man, be he engineer or not, to give consideration to the public interest so that proper judgment may be exercised for the benefit of the community as a whole, he declared.

There is a tendency, he said, quoting from an article in a daily paper, to make public utilities less local in nature. Even now they are interurban and inter-state in their scope of service.

Huge sums are invested in public utilities. Fourteen billion dollars has been invested by financiers and stockholders, he said. This investment brings a gross yearly income of $3,000,000,000. In the electric utility field there is alone invested more than $3,000,000,000 with a gross annual income of more than $500,000,000.

Chicago, having 2½ to 3 per cent of the total population of the United States, produces 5 per cent of all the electric energy generated in this country. For this energy, public utilities here receive 6 per cent of the gross annual income. This rate is secured on an investment totalling 3 per cent of the total capital invested in the United States.

If all the public utilities of the nation could be concentrated so as to result in a minimum of operation and expense, a great saving for the people would be effected. This saving would not only mean economy for the public, but would also conserve the coal supply of the nation, he said.

Coal is the prime source of energy. All of the water power of the United States, if it could be utilized, he asserted, would not be sufficient to produce enough power for this country's demands for energy.

"In many parts of the United States, so far as public utilities are concerned, the public has robbed the utilities," he said. "By forcing the companies to supply service below cost of labor, material and interest on the investment, utilities of the public have actually found it necessary to operate at a loss. However, as such procedure retards the business success of the community, the effect has been greater on the public than on the owners.

"The engineer has a particular opportunity to become familiar with the underlying, fundamental principles of public questions," he concluded.

J. H. Libberton presided. He was assisted in making arrangements for the luncheon by Benjamin Wilk.

There were nearly 500 present, the attendance exceeding even the most optimistic estimates of the committee in charge.

The luncheons are to be held each months at which time a prominent speaker will appear.

If you were not at the first W. S. E. luncheon don't fail to attend the second.

NEW FORMULA EVOLVED

Halbert P. Gillette, editor of *Engineering & Contracting,* has prepared an interesting formula for predicting average wholesale commodity prices. He has applied this formula to each year from 1879 to 1919 inclusive, and has found that the results compare very closely with the corresponding average price for each of those years.

The formula is:

$$P = \frac{0.86\,MT}{CE}$$

"P" equals the weighted average wholesale price of commodities as given by the Department of Labor.

"M" equals the total currency in circulation on June 30th of the given year.

"T" equals the annual turn-over of money or "C" divided by "B."

"C" equals the total bank clearings outside of New York City during the given year.

"B" equals the total individual bank deposits in the United States as of June 30th of the given year.

"C" equals the total population at the end of the year.

In further explaining his formula, Mr. Gillette says that the productive efficiency between the year 1879 and 1904 inclusive was 1 plus 0.012N, and "N" is equal to the number of years from 1879 to the given year up to and including 1914. The productive efficiency from 1905 to 1919 is equal to "E" or 1.3.

"m" is equal to the per capita money in circulation.

Mr. Gillette will, later on, discuss the derivation of the formula together with its full economic significance, in *Engineering & Contracting.* This paper should be of a special interest to those engineers who are seeking to remedy the present status of prices.

BUILDING HEIGHTS INCREASED

Chicago Council Adopts New 260 Feet Limit

An ordinance has been adopted by the City Council of Chicago changing the height limit of buildings from 200 feet, which has been the limit for the last nine years, to 260 feet, thus permitting the erection of 20-story buildings.

Whether this is wise legislation or not will be based on the effect on the entire city and not upon the loop district alone. The Public Affairs Committee of the Western Society gave consideration to the subject and sent the following resolution to the City Council and the Mayor:

"Whereas, There is now pending before the Board of Aldermen, City of Chicago, an ordinance providing for the construction of buildings in the City of Chicago to a height of 260 feet; and

"Whereas, An ordinance has been recommended by the Building Committee of the City Council and adopted by the Board of Aldermen providing for the appointment of a Zoning Commission; and

"Whereas, Such Zoning Commission, when appointed by the Mayor, will be authorized to make a scientific survey of the building conditions of the city of Chicago, and to recommend the adoption by the city of zones and regulations with regard to the location of industries, the usefulness and type of construction of buildings therein, *including the height thereof;* and

"Whereas, It is recognized that the proper height of buildings in any zone depends upon the character of the improvements in each zone, and upon the width of the streets adjacent thereto, and that the limits when adopted should be such as will provide for the health, safety and convenience of the people of Chicago; and

"Whereas, Such adopted heights may in *certain locations* and for *certain uses* properly exceed even the limits now purposed by ordinances; therefore be it

"*Resolved*, That in the opinion of the Public Affairs Committee of the Western Society of Engineers the pending ordinance changing the height limit of buildings should be referred to the Zoning Commission and new regulations with regard to the height of buildings should be adopted only as a part of a *comprehensive zoning plan* for the city of Chicago."

The question is not one that involves the limitations of the heights of buildings to even 260 feet, but rather, should we proceed in an orderly and logical manner and prescribe rules based on a broad study of the city as a whole. The Aldermen of Chicago evidently believe in immediate legislation and have bowed to a demand which is contrary to the recommendations of many Civic and Technical Societies, which are composed of interested citizens.

Besides the Western Society of Engineers, other organizations which opposed the present legislation are the City Club, Woman's Club, Illinois Society of Architects and the Illinois Chapter American Institute of Architects. Building Commissioner Bostrom expressed views similar to those of the Society.

The City of St. Paul, in preparing for a comprehensive City Planning System, has appointed George H. Herrold of the Department of Public Works of Minnesota, managing director and engineer in charge. It is planned to spend approximately $50,000 in the next two years toward preparing proper surveys and plans.

RECOMMEND CAMPAIGN FOR ENGINEERING BUILDING

The committee of the Western Society on the address of Retiring President Baldwin at the annual dinner January 28, 1920, has submitted a report to the Board of Direction recommending the execution of the policies advocated by Mr. Baldwin. This report, which was ordered published by the board, is presented herewith:

To the Board of Direction of the Western Society of Engineers:

Your committee has reviewed the address of Retiring President Baldwin, which, with unusual breadth and fine spirit, sets forth the principles which should actuate every forward-looking individual at this time, and particularly engineers. We thoroughly and heartily endorse the views expressed and take pleasure in making the following comments on some of the important recommendations contained in the address.

Engineering Building:

The construction of an adequate building to serve as a center for the activities of engineering societies has long been the desire of the Western Society of Engineers. That the realization of this desire should be one of the important aims of this year, as he recommends, we fully concur in. The launching of an active campaign for such an engineering center could profitably be placed on your program for early attention.

Co-operation with National Societies:

The many discussions had by and through the Development Committees of the various national societies indicated the very positive desire for an influential local engineering body to include within its membership, and to have special sections for the members of the national societies. It is believed that the discussion has been sufficient to point out clearly just how the plan of co-operation can be carried out, and definite steps should now be taken on this very important subject. Incidentally, in this connection the apparent confusion still existing in the minds of many of our members as to whether we are a local or a regional society should be definitely cleared up, and if a change in name is necessary, sentiment alone should not stand in the way of making the change.

Endowments and Encouragement of the Younger Members:

The securing of endowments for awards, such as the Hunt Award, should be encouraged, as this will undoutbedly serve to stimulate interest in professional work as expressed through Society activities and will help the Society as much as the individuals earning the awards.

In his reference to the younger members, Mr. Baldwin undoubtedly had in mind the obligation of the older members to the younger men who will carry the burdens and the duties and the honors of the profession in the future years. It is clearly to the interest of the profession and therefore our duty to do all that is consistently within our power to aid in the development, both as engineers and as citizens in the broadest sense, of all our fellows in the profession. This naturally carries with it efforts to improve the status and the well being of engineers in all their various lines of activity.

The Engineer's Responsibility:

Mr. Baldwin's eloquent and broad-visioned analysis of the present day problems is very inspiring and deserves and should have the widest publicity that the Society can give it through every available channel, such as the technical press, including especially college publications, and in letters to other societies. The sound engineering logic with which the decadence of past civilizations was presented, and the clear deduction giving a violation of law as the reason therefor, should appeal to every engineer. Indeed, the appeal goes far beyond engineers; but the address clearly pointed out the particular duty of engineers to apply in their analysis of present day conditions the same reasoning that they use in the solution of their professional problems. They will then conclude, as did Mr. Baldwin, that the world is suffering most at this time because of the violation of that social law familiarly known as the Golden Rule. Our engineering structures are designed in accordance with the laws of materials or they do not endure; no more can our social structure, civilization, long endure unless this Great Law is given expression in our every act. Having reached this conclusion, the answer will be self-evident. It is clearly the duty of engineers, and particularly of our Society—representing, as it does, a body of men favored by education and training to think logically and to act wisely—to do all that is humanly possible to bring into the relations with their fellows on all sides the application of that law, to emphasize which was the main purpose of Christ's life. Appreciating the soundness of the argument and of the appeal, we should pledge ourselves anew to a constant effort to make the application of this principle a practical reality.

Respectfully submitted,

Committee on Retiring President's Address.

March 20, 1920

A. R. E. A. MEETS

Association Faces Problems of Maintenance. New Officers

The twenty-first annual convention of the American Railway Engineering Association, held at the Congress Hotel, March 16-18, was the most successful of any convention ever held by that body.

Twenty-two standing committees and two special committees presented reports. Specifications for steel rails and iron and steel structures were adopted.

The problems ahead of the Association are those of maintenance rather than construction, said Earl Stimson, president of the Association. He deplored the fact that young engineers are shunning the railroad service. It should be the duty of the Association, he said, to encourage young men to take up railway work.

The A. R. E. A. is not to be absorbed by the American Railroad Association, of which R. H. Aishton is president, as was the belief expressed some time ago. A proposition to make the A. R. E. A. a part of the A. R. A. engineering section was voted down by the Association by a large majority, he declared. The Association will, however, act as a division of the A. R. A., Committee members of the A. R. E. A. now acting as members of similar committees of the A. R. A.

E. H. Fritch, secretary, reported a total membership of 1,639. The Association is strong financially, having a present cash balance in its treasury of $43,774.

All specifications and plans adopted at this convention will be published in the Manual of the Association to be issued this year. A new volume of the Manual has not been issued since 1915, although various Bulletins have come out from time to time.

It was the sentiment of the convention that there should be a much wider and more careful use of A. R. E. A. standards.

The annual dinner was held the 17th at the Congress, with President Stimson presiding. The speakers and their subjects were Rev. Henry J. Cody, Member of Legislature of Ontario, "Education as a Factor in Reconstruction," and Dr. W. E. Stone, President, Purdue University, "The College and the Industries."

Officers elected for the ensuing year are:

President—H. R. Safford, M. W. S. E., assistant to president, C., B. & Q. R. R., Chicago.

Vice President—L. A. Downs, vice president and general manager, Central of Georgia, Savannah.

Treasurer—George H. Bremner, M. W. S. E., district engineer, Interstate Commerce Commission, Chicago.

Secretary—E. H. Fritch, Chicago.

Directors—E. B. Katte, chief engineer of electric traction, N. Y. C. R. R., New York; J. M. R. Fairbairn, chief engineer, Canadian Pacific R. R., Winnipeg; and F. E. Turneaure, M. W. S. E., dean, College of Engineering, University of Wisconsin.

It is estimated that if every man would turn out a third more work for two months he would increase his wages one-third. This does not mean, of course, that he would receive one-third more money, but the price of what he must buy would be reduced so that the difference in the cost of living would be equivalent to an advance in wages.—*Topeka State Journal.*

PUBLIC AFFAIRS COMMITTEE

Reports of chairmen of sub-comtees of the Public Affairs Committee featured the meeting of the committee March 22 at the Engineers' Club.

The sub-committee on Constitutional Convention, J. L. Jacobs, chairman, is composed of Messrs. Jacobs, Canfield, Alvord, Schmidt, Schuchardt, Barker and Gerber. Mr. Jacobs is also chairman of a similar committee of the Technical Societies of Chicago.

Messrs. Green, chairman, Schmidt, Allen, Combs and G. W. Carr make up the sub-committee on City Zoning. The chairman reported progress in an effort to secure an engineer member of the Chicago Zoning Commission. Other sub-committees on Highways, Engineering, Employment, Urban Transportation and Smoke Abatement made encouraging reports.

M. L. Greeley, chairman sub-committee on Highways of the Public Affairs Committee, reported on March 29, the personnel of his committee as follows:

G. A. Quinlan, J. A. Dailey, Frank Windes, W. G. Evans, G. W. Tillson.

The sub-committee on Engineering Employment, G. W. Ristine, chairman, is as follows:

J. P. Cowing, C. C. Brooks, E. H. Heald, S. I. Stocking.

The members of the sub-committee on Urban Transportation, H. H. Easterly, chairman, are:

Col. E. J. Blair, Maj. R. F. Kelker, D. J. Brumley, J. V. Sullivan.

J. L. Jacobs, chairman sub-committee on Constitutional Convention, presented a report on consolidation of government, home rule and limitation of Chicago's representation in the legislature, which, when adopted, will be published in the Journal.

A. I. E. E. NOMINEES

The directors of the American Institute of Electrical Engineers have nominated the following officers to be voted on July 31:

President—A. W. Berresford, Milwaukee.

Vice Presidents—C. S. Ruffner, New York; E. H. Martindale, Cleveland; Charles Robbins, Pittsburgh; C. E. Magnusson, Seattle; C. S. McDowell, U. S. N.; L. T. Robinson, Schenectady.

Managers—E. B. Craft, New York; Harold B. Smith, Worcester, Mass.; James I. Lincoln, Cleveland.

Treasurer—George A. Hamilton, Elizabeth, N. J.

PROGRAM COMMITTEE

One of the most effectual means of keeping the Society alive and active is through the technical meetings held practically every Monday night in the Society rooms.

The task of arranging these programs of technical discussion falls to the Program Committee, which is composed of the chairmen of Society Sections and several members at large. This committee must arrange for at least fifty meetings a year. Such an extensive program requires careful and considerate thought.

Many subjects are offered for discussion, but the committee approves only those that are of special merit and value. Some subjects that are presented before a Section of the Society are not suitable for presentation before a general meeting, and vice versa.

The Program Committee urges that the members of the Western Society forward to the chairman a list of subjects they desire to have discussed in technical meetings, with, if possible, suggestions as to the authors of the papers. Perhaps the writer himself may have a subject for presentation. Or, if he has no special subject in mind, perhaps some other engineer or fellow professional man is known who has a subject of general interest to the Society or one of its Sections. Address all communications to the Chairman Program Committee, Western Society of Engineers.

RECEPTION COMMITTEE

At the initial meeting of the Reception Committee, April 5, at the Engineer's Club it was decided to enlarge the committee so that all sections of the Society would be represented. It is planned to have at least two members of the committee present at each Society meeting. If the meeting is large members of the committee are to draft additional members to assist.

Plans for serious work were outlined. It is the purpose of the committee to promote the social side of the technical meetings—to make the members better acquainted with one another.

This committee will aid the Increase in Membership Committee by giving names of guests to this committee and inviting the guests to attend future meetings.

It was decided to issue new cards and badges to members of the committee.

Members of the committee are: J. E. Love, chairman, A. W. Branum, E. A. Rummler, L. E. Dierks, W. H. Flood, M. J. Hammer, S. T. Nelson, W. S. Lacher, Max Lowenberg, Benjamin Shapiro and T. W. Ingemanson.

THE ENGINEER AND UNIONISM*

By R. M. Hosea, M. W. S. E.

Although underpaid, as a rule, and the great majority given but little adequate recognition, for their part in the building up of our present state of civilized society, the Engineer is not likely to take to Unionism. A Union, today, demands the right to strike to enforce its demands. The leaders are usually careful to enjoin only "peaceful persuasion" in their labor controversy, although inciting the strike and enlarging upon all the real or fancied grievances that can be enumerated. Then once engaged in the struggle to gain their point, the individual radical, sorehead or discontented striker cannot be controlled, and we have "pickets," the boycott and other interferences with the rights of every American citizen to life, liberty and the pursuits of happiness.

Do our citizens possess an inherent, inalienable, constitutional right to strike if and when they please? The A. F. L. seems to think they have, and announce a political campaign and the intention to elect a Congress and President who will see that LABOR is secured in this right. If this right is common to all the people, under our Constitution, then it cannot be abridged, withheld or amplified, or restricted, or exercised by any less than a majority of all the people. This fundamental principle of our Republic must determine the right to strike.

No one has any right to injure another; and when the exercise of his asserted right to strike does injury to another—and particularly when it causes loss and injury to a large part of the innocent public—we must most certainly deny that any one has an inherent or constitutional right to strike.

One of our college professors recently made a remark that "a man may have a right to strike, but it ends where the public nose begins." When any man's right is opposed to the greater right of the Public, he exercises it in defiance of the Public and without constitutional justification. Our Anglo-Saxon ancestors in 400 A. D. brought to England the principles of free government, the right to participate in government through elected representatives. In 1215 A. D., at Runnymede, King John was forced to sign the "Magna Charta" and later at Lewes, Henry IV was forced to call a Parliament by Simon of Montfort. Tudor and Stuart Kings were not able to take the liberty of the English people and their Constitution and Parliaments.

King George IV was not able to "tax without representation" in America and the leaders in England and France, through the example of the United States have firmly established Constitutional, popular governments, of the people, for and by the people, through their elected representatives.

The basic principles of our government are imbedded in the old legal maxim of Anglo-Saxon law, "So use your own as not to injure another's equal right." And this has always been the moving spirit of our laws and ideas.

Many have thought that it might be better in our United States, if when our representatives did not carry out the popular will, we could turn them out as in English and Colonial Parliaments, where a vote of "want of confidence" compels the old government to go out of office and a new election to be held, while we must wait for two or three years for the appointed time, our lawmakers and executives meanwhile doing as they please.

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*Reprinted from the Official Bulletin, Colorado Society of Engineers.

There might be danger in this; for if such a faction as the one that recently tried to form a "triple alliance" of railway and farm labor and the state federations of labor, in order to elect officers and lawmakers "who will fulfill the aims of organized labor," were to be successful, we should have a very un-American state of affairs indeed.

Candidates of such an alliance would be sworn of course to conduct their offices and make laws for *all* the people; but, like the subjects of the Kaiser who took oath of allegiance on becoming American citizens, the oaths of office of such lawmakers would have a reservation in favor of the four or five per cent of our people belonging to "organized labor," or, in other words, would be "scraps of paper."

Much as the Engineer may feel dissatisfied with the conditions he suffers from, he cannot approve principles of action like those illustrated above. His education and training make him too fair minded to take any position in these matters but one that guards the public interest. Nature distributes her blessings upon the just and the unjust alike and the Engineer's bent of mind, dealing as he does with Nature's laws, is not favorable to the idea of grasping what he can, regardless of how he may injure another's interests. His code of Ethics is founded on equal justice and equal opportunity for all.

He is not likey to strike for his rights, but is coming to see that concerted action, political action it may be, should govern his conduct in securing his proper rights. Let him then take his proper place in politics and through real "peaceful persuasion" claim and prove the justice of his claims.

Let him study the history of the adoption of our Federal Constitution and the debates attending its adoption in the different states.

Let him study parliamentary law in his meetings and be prepared to lead in debate and not leave the leadership to lawyers and politicians.

Thus, we think, will the Engineer best assure recognition for himself and his profession, for in the end the mind rules and not force and coercion.

FROM ENGINEERING COUNCIL

Super Power Investigation as proposed by Secretary of Interior was urged before House Committee on Appropriations March 16th by Engineering Council's Committee, composed by W. S. Murray, A. I. E. E.; L. P. Breckenridge, A. S. M. E.; D. C. Jackson, A. I. E. E. and M. O. Leighton, A. S. C. E. Details of the advantages to the Boston-Washington industrial district through the use of hydroelectric, tidewater steam and mouth of mines steam power were emphasized, especially the fact that at least $300,000,000 could be saved each year. The House Committee showed unusual interest in this plan.

A Topographic Mapping Appropriation to the extent of $600,000,000 was urged in the hearing given M. O. Leighton, A. S. Baldwin, and others who appeared in behalf of the engineers. This is the appropriation that engineers from all sections of the country have been urging. It contemplates a complete topographic map in twelve years. The program for the use of this appropriation has the sanction of the Board of Surveys and Maps.

The Army Reorganization Bill passed the House March 19th, providing for continuation of Chemical Warfare Service and a strong Signal Corps. An amendment to maintain separate a Construction Corps which had been passed March 12th was reversed. The present status of the bill will retain Construction Corps and Motor Transport Corps in Quartermaster Corps.

The Navy Appropriation Bill was reported recommending $425,000,000 against $550,000,000 estimated. Navy "Bureau of Steam Engineering" was changed to "Bureau of Engineering," having charge of practically every class of Navy engineering work.

The Danish Radio Commission will visit the U. S. in April for the purpose of establishing radio service, U. S. to Denmark.

HOOVER ANNOUNCES CANDIDACY

Herbert Hoover has definitely announced his candidacy for the Presidency of the United States on the Republican platform. Mr. Hoover was recently presented with the Washington Award of the Western Society of Engineers.

Mr. Hoover made his declaration of purpose in a telegram to a Californian active in his interests. He said:

"I had not wished to enter nor could I hitherto see any real public service by entering into partisan political discussion, more especially pending the clarification of the diverging views of the different groups in the parties on the great new issues."

He said that "the recent developments over the treaty," the failure to settle our economical problems and "particularly the many urgent representations that I have received * * * convince me that it is my duty to confirm the action that my republican friends have already taken without consulting me."

Numerous organizations sponsored by Mr. Hoover's associates had sprung up all over the country for the purpose of furthering his candidacy before this acceptance was made.

He went on to say, "If the Republican party—with the Independent element with which I am naturally affiliated—adopts a forward looking liberal, constructive platform on the treaty and our economic issues, and if the party proposes measures for sound business administration of the country, and is neither reactionary nor radical in its approach to our great domestic questions, and is backed by men who undoubtedly assure the consummation of these policies and measures I will give it my entire support.

"While I do not and will not myself seek the nomination, if it is felt that the issues necessitate and it is demanded of me, I cannot refuse."

Mr. Hoover is the first engineer to announce himself as candidate for President since the time of George Washington. It is rather a coincidence that so soon after being presented with an award for meritorious public service named in honor of our first president that Mr. Hoover should be called upon by the public to offer himself for perhaps the greatest service he can render to the American Nation.

One by one technical societies and engineering organizations, technical publications, trade journals and business papers are swinging to Mr. Hoover's support.

The Northwestern Association of Members of the American Society of Civil Engineers, Duluth, Minn., has adopted and circulated a resolution endorsing Herbert Hoover for the Presidency of the United States to "insure the Nation's affairs being handled on an efficient, non-partisan basis."

The resolution follows:

"WHEREAS, The Northwestern Association of Members of the American Society of Civil Engineers believes that our most important problem at this time is increased production and service in all lines of industry to provide for our own needs and to render necessary assistance to others. This will require a general survey of our national resources in order to provide proper methods for developing and properly conserving those resources; and,

"WHEREAS, Herbert C. Hoover is a man of international reputation as an executive with administrative abilities of the highest type and order, particularly fitting him for dealing with the serious economic problems of reconstruction now confronting the American people; and,

"WHEREAS, Mr. Hoover's reputation for strength of character and for integrity of purpose can be depended on to give the Nation an honest and efficient administration free from partisan politics; therefore, be it

"*Resolved,* That the Northwestern Association of Members of the American Society of Civil Engineers, in meeting duly assembled, endorses Herbert Hoover for President and solicits everybody, but more especially the Engineering bodies of the United States, to join with it in forming an organization to further the election of Mr. Hoover and in such other activities as will insure the Nation's affairs being handled on an efficient and non-partisan basis, and be it further,

"*Resolved,* That copies of this resolution be sent to all Engineering organizations and technical journals throughout the United States and urge that all proper steps be taken to accomplish the election of Herbert C. Hoover for President."

John A. Beeler, traffic expert, has been retained by the Chicago Surface Lines to make a survey of traffic conditions in the city. It is the purpose of the investigation to evolve a plan of relief for congested districts of the city.

In a bill recently agreed to by the Senate and House Conferees, War Department equipment for use in the construction of Federal and State roads will be available. The material made available will include all surplus industrial railway equipment, concrete mixers, cranes, etc.

The Senate Committee on Public Lands recently held a hearing on the Jones-Reavis Bill to create a National Department of Public Works. Among the engineers who testified before the committee were M. O. Leighton, Chairman of the National Public Works Department Association; Professor G. F. Swain, formerly President, American Society of Civil Engineers, and Philip N. Moore, Past President, American Institute of Mining Engineers.

Senator Norris, acting Chairman of the Committee, stated at the conclusion of the testimony that the Committee was very much interested in the matter. Senator Kendrick suggested a consolidation of the public works functions of the Government with the Interior Department. Senator Chamberlain showed a lively interest in the provisions of the Jones-Reavis bill made for the Corps of Engineers. The necessity of some reorganization was generally admitted, due to the inefficiency of Government methods.

JOURNAL
OF THE
WESTERN SOCIETY
OF
ENGINEERS

"To promote and advance the science and art of engineering."

BOOST CHICAGO

By all means boost!

The question is what is the most effectual way of boosting.

It is an axiom of business that a satisfied customer is the best advertisement.

How then can Chicago have satisfied customers or citizens?

The answer: Support an efficient city government, which will promote the safety, health and convenience of the citizens; which will put into effect a consistent budget of expenditures and which will establish a tax rate that will provide sufficient income.

In these affairs, as citizens, we are interested and because of our special training as engineers we can render service. Our criticisms should be constructive.

The Public Affairs Committee this year is mapping out some promising activities.

This committee meets each Monday for lunch at the Chicago Engineers' Club. Any member of the Western Society is invited to take part in these meetings. Will you come?

Let's boost Chicago!

We believe in Chicago and we believe in boosting our city.

What is the best way?

BOARD OF DIRECTION

The regular March meeting of the Board of Direction of the Western Society was held on the 8th.

Students of the sub-junior engineering course at Marquette University, Milwaukee, will be accepted as Student Members of the Western Society.

The following communication from Herbert Hoover was presented:

Washington, D. C.,
March 6, 1920.

Mr. F. K. Copeland, Pres.,
Western Society of Engineers,
Monadnock Block, Chicago.

Mr. dear Mr. Copeland:

I wish to express my deep gratitude for the very high honor paid to me by my engineer colleagues in the recent presentation of the Washington Award. I shall indeed retain it as one of the most precious possessions in my family.

Yours faithfully,
HERBERT HOOVER.

The organization of the Railway Engineering Section was approved.

EDGAR S. NETHERCUT,
Secretary.

We gleaned the following from B. L. T.'s "Line o' Type or Two" from the Chicago *Tribune*:—

"'The mind,' observed the Trib, in discussing the new bridge over the Chicago River, 'which is able to conceive and execute such a structure is developed because it is rewarded by both pay and position.' Is it not, rather, developed because, like the artistic mind, it takes the channel which it particularly wishes to follow? As for pay, if one will glance over the want ads in the engineering journals one will find that the salaries, offered and asked for, are some distance this side of the dreams of avarice."

EMPLOYMENT SERVICE

NO CHARGE is made for opportunities announced in this section of the Journal.

ANNOUNCEMENTS must not be more than sixty-five words in length and will not be inserted more than twice during a period of two months, during which time all records will remain in the active files. All correspondence will be treated confidentially.

APPLICANTS for situations, not members of the W. S. E., must have card of introduction from a member of the Society.

ALL REPLIES should be addressed to the key number indicated, in care of Employment Bureau, Western Society of Engineers, 1735 *Monadnock Block, Chicago.*

SITUATIONS WANTED

B-300: CIVIL ENGINEER, SEVEN years experience, now employed as City Engineer and City Manager, city of 7,000, wants position as construction superintendent or sales engineer. Age 28, married. Salary $300 per month.

B-301: SITUATION WANTED—By man of 31 who has had good practical training in civil engineering. Ten years experience as field engineer and draftsman.

B-302: GRADUTE C. E., AGE 27, desires position where initiative and executive ability as well as sound technical knowledge are required. Experienced in heavy construction, location and plant operation. At present located as supervising engineer on plant management and design involving heavy dredging and excavating operations.

B-303: GRAD. ARCH. ENG. DEsires position as superintendent or assistant in building construction. Six summers with small contractor, nine months designing reinforced concrete structures.

B-304: MECHANICAL ENGINEER. Fifteen years experience in power and mechanical construction. Ten years as superintendent of construction and operation of gas and steam power and air compression plants. Will accept position as superintendent of construction, mechanical engineer or master mechanic.

B-305: GRAD. C. E., U. OF ILL., six years experience on railroad drainage, sewers, roads and pavements, surveys, topography, mapping, design, estimating and construction, desires position as city engr. or asst., preferably in small city. Salary $250 per month.

B-307: GRADUATED M. E., YALE. Nine months in U. S. Army Service; Asst. to Elec. Eng. at Conn. shipyard. Traveling salesman in Illinois and Iowa selling warm air furnaces to dealers. Wishes any engineering position.

B-308: GRADUATE E. E. ARmour Inst.; telephone engineer four years. Consult. Engr. and Supt. of mfg. plants, wood working industry. Desires position in wood working field where past experience may be applied.

B-309: GRAD. ARMOUR INST. desires position with architectural firm. Understands drafting, designing, detailing and general work. Licensed arch. exam, 1917. Salary $250.

B-310: EXPERIENCED M. E. CAPABLE of handling general mechanical problems and special structural construction desires position. Can handle men and experienced in supervising, designing, estimating or constructing.

B-311: MECHANICAL ENGINEER, experienced in design, contracting and installation of power plants, heating, plumbing and mechanical equipment of buildings, desires executive position or to act as selling representative in Chicago and vicinity.

B-400: ELECTRICAL ENGINEER, age 36. Technical Grad., broad experience in Power Plants, sub-stations, and transmission systems, including large system of mixed water and steam plants; desires position with Hydro-electric power project.

B-401: GRADUATE CHICAGO Tech. Age 24, single, desires position in Chicago, as engineering draftsman. Four years experience in design and detail for buildings of structural steel re-inforced concrete, and timber. Salary, $250.00.

B-402: ENGINEER, EXPERIENCED in furnace and boiler construction work, desires position as test engineer.

B-403: GRADUATE M. E. Age 40, married, wants position as factory Supt. on Production Engineering.

B-404: RAILROAD ENGINEER, four years experience in railroad field, and office engineering, consisting of Maintenance of Way, separation of grade crossings, and new construction, desires position as assistant engineer in maintenance of way dept. At present employed. References.

B-405: MAN EXPERIENCED IN re-inforced concrete pile driving, and water front improvements, desires position as Foreman. Been with the U. S. Gov. for 12 years on construction work in Navy Yards.

B-406: SITUATION WANTED. Young man 25 years of age, wants position with growing Mfg. Co. which will eventually lead to executive responsibilities. Six years experience in production and time study work. Salary to start, $200.00 per month.

SITUATIONS AVAILABLE.

A-30: WANTED—YOUNG MAN capable of making drawings from designer's sketches for Engineering Dept. Estimating and working eventually into Engineering Sales Dept.

A-31: TECHNICAL GRADUATE —Young man, technical education, civil or mechanical engineer graduate preferred, for office position with leading Chicago iron and steel concern doing country-wide business. Offers technical and commercial training; excellent opportunity to learn the heavy steel line; good prospects for advancement with a concern whose policy is to develop its own men for responsible positions. State experience, if any, education, salary expected.

A-32. LARGE ENGINEERING concern desires several Architectural, Structural Steel and Structural Concrete draftsmen.

A-33: WANTED—STRUCTURAL draftsman familiar with railroad buildings such as engine houses, small roadway buildings, shop buildings, etc.

A-34: WANTED—DRAFTSMAN or designer. Prefer M. E. graduate capable of designing. Applicant should be experienced with Rolling Mill and Wire Mill machinery, heating furnaces, boiler plants, mill buildings and general mill work.

A-35: WANTED—TWO GRADUATE civil engineers of three years experience in railway work, preferably in field construction or maintenance. Man must have desire for editorial work, with high publishing company.

A-40: WANTED—CONSTRUCTION Engineer for out of town work. One who understands carpenter work, and steam fitting in simple one story building construction.

A-41: WANTED—DRAFTSMAN with possibilities of a salesman, with a concern which develops its own men.

A-42: DESIGNING ENGINEER. If you are equipped to take hold of an established line of pressure Reducing Valves and push them to perfection, you have an opportunity before you.

A-43: SALES ENGINEER HAVING coal tipple experience, for Eastern Position. State experience in detail. Position of opportunity with progressive corporation.

A-44: GENERAL SUPERINTENDENT, Building Construction. Must have experience in structural steel and industrial building construction, and be competent to take charge of large building construction job. Position must be filled quickly. $300 per month.

A-45: WANTED—DRAFTSMAN for detailing plate metal work. Permanent position for capable man. Location Chicago. Advise experience, salary expected, and date you can report for work.

A-46: WANTED—GRADUATE Mechanical Engineer by one of the largest manufacturers of Hydraulic Machinery, Oil Engines, air compressors, mining machinery, and other lines. Man familiar with power plant practice, as Sales Engineer. Also desire a number of this year's graduates to enter our Student Salesmen's Course. Full information on application.

A-47: WANTED—DRAFTSMAN: Mechanical and Structural experience necessary. Apply at once to Mr. Inman, American Steam Conveyor Corporation, 326 West Madison St., Chicago, Ill.

A-47: WANTED—ENGINEER. AN old established concern in heavy iron and steel lines, location Chicago, doing country-wide business, has opening for graduate mechanical or civil engineer with some experience in plate and sheet fabrication.

ADDRESSES WANTED.

Mail from the Western Society has been addressed to the following engineers but has been returned because of incorrect address. The last known address of the member is printed herewith. Members of the Society having information as to the location of these men will greatly favor the Society by sending their address so that proper information as to the activities of the Society may be sent them.

Roy W. Anderson.

Ralph G. Culbertson, 1601 Beatmans Bank Bldg., St. Louis, Mo.

Homer W. Deakman.

W. M. Kallash, Box 38, Charleston, W. Va.

M. D. Kolyn.

Wm. F. Kurfess, 7125 Euclid Ave., Chicago.

Theo. F. Laist.

Fred A. Locke, 2017 Maple Ave., Evanston, Ill.

James M. McFarland.

T. R. Minert.

Wm. S. Morton, 865 Pacific Bldg., San Francisco, Cal.

Vincent Pagliarulo.

Roger C. Palmer.

Jerre T. Richards.

Albert S. Chiavitz, c|o H. Muller Mfg. Co., Ltd., Sarnia, Ont., Can.

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Engineering in Trade Association Work

By Wharton Clay, M. W. S. E.
Commissioner, Associated Metal Lath Manufacturers.

Presented March 1, 1920. Standards Engi

A TRADE ASSOCIATION is a voluntary organization of competitors such as manufacturers, jobbers or dealers, in the same general line of business. These competing interests join for material benefit. They are sometimes associations of men in the same line in different cities, as central stations, street railway operators, and others who manifestly are not in direct competition, but always commercial interests that have the same general problems of manufacture, development or sale to face. This type of association, however, does not include the usual Chamber of Commerce of a city, which would be made up of firms in varying lines of business, nor does it include professional or public societies, for instance, the American Society of Civil Engineers, the National Fire Protection Association or others whose membership is individual in nature.

Four hundred fifty such associations were listed by the U. S. Bureau of Commerce in 1917, and hundreds more have developed within the past few years. Many industries in which no organization was in existence found themselves so widely divergent in types, styles and products that it was impossible for the United States Government to deal with them when war came upon us. In fact, the Government fostered the organization of competitors into trade associations; which, having now discharged their war duties, are continuing because they fill an economic need not only within the ranks of the industries themselves, but also in service to the general public. They will, henceforth, always be prepared to serve the country in times of peace or in times of war, insuring a speedier mobilization of industry than would be possible without them. They are able to co-operatively develop foreign markets or economically promote domestic consumption.

THE TRADE ASSOCIATION IS NOT A NEW IDEA.

In the Middle Ages, according to Georges Renard, in his history of this important commercial movement, "the guild (of the proprietors) was first and foremost a fighting organization for the defense of the trade interests of those who belonged to it. It was jealous both of the welfare and of the honor of the craft—two things intimately connected; for it realized that good reputation is one of the conditions of good business."

With regard to production, the guilds prided themselves on giving an official guarantee to the consumer; hence, the minute instructions prescribing the number of vats into which the Florentine dyer was to dip his materials and the quantity and quality of the coloring matters he was to employ; the size of the meshes in the nets which the Roman fisherman was to cast into the Tiber; the length of the pieces of linen to be woven by the Parisian spinner, regulated by that of the tablecloths which covered the table of "good King Philip"; or the color and size of the garments which the silk workers of Constantinople were to make.

Sale was as carefully watched over as production. Not only had the weights and measures to be verified and controlled in conformity with carefully preserved standards, but at Florence, for instance, the "iron ruler" of the Calimala was the standard for measuring woolen materials.

The second ruling idea of the Guild Statutes was the pursuit of moral and social aims; it desired to establish between the masters of which it was composed, honest competition—"fair play." It desired to prevent the great from crushing the small, the rich from ruining the poor, and, in order to succeed, it tried to make advantages and charges equal for all. Its motto so far was: Solidarity.

A system does not disappear without bequeathing traditions and customs to its successor. While the death of the Medieval Guilds was due to complex causes, it is curious to note that the most potent factor was the development of machinery by the early engineers.

If we remember the thousand-and-one prohibitions with which the guild statutes bristled—the prohibition to mould seals with engraved letters, the regulations which in every craft prevented all change and consequently all improvement in manufacture, it is easy to understand how "great" industry, without deliberate effort, but by its very development, overthrew the economic order which had reigned in the Middle Ages. The guilds, moreover, with the best intentions in the world, fought against innovations which seemed to them abominations. Today, on the contrary, it is the object of most trade associations to develop and foster the progressive spirit.

In America our problems are different, but the need for associations is as great as in the Middle Ages. President Wilson wrote to Federal Trade Commissioner Hurley that:

> "These associations, when organized for the purpose of improving conditions in their particular industry, such as uni-

> fying cost accounting and bookkeeping methods, standardizing products and processes of manufacture, should meet with the approval of every man interested in the business progress of the country."

In an address before one of the groups, William C. Redfield, then Secretary of Commerce, summed up the value of the trade association as follows:

> "The day of individualism was suited to the formative stage of American business. The days are over when business concerns considered competition to be keeping to themselves everything that they could learn and going alone into the markets of the world to plow their way as best they could, without regard for anybody else, and with especial disregard of their competitors. Commerce has outgrown that stage, and nowadays we have to consider business as a whole in its larger and common interest.
>
> "* * * I beg of you to take up seriously the question of closer interest and co-operative organization of business men on common grounds of mutual interest."

Mr. Charles P. Steinmetz, Chief Consulting Engineer of the General Electric Company says:

> "Industry, and with it all our modern civilization, depends on engineering, which is nothing but applied science, and science thus is the foundation, and scientific research the ultimate means which have created our civilization. Of late the industrial development has been so rapid and the demand for the results of scientific research so great and urgent that universities, which for ages have been the chief homes of scientific research, have not been able to supply it and the industries had to enter the field of scientific research themselves."

While research work started with the individual concerns and is still carried out by all the larger corporations, it was quickly seen that the results were used by others, so it was natural to organize in a manner that all who gained could contribute. This combined effort provides more funds, and the benefits of the research are more quickly given to the public at large.

In these days of advancing costs we need the aid of science and engineering more than ever. Every effort must be put upon utilization of waste, economical manufacture and durability of product and through the Associations, the discoveries or improvements may be put into practice by entire industries at once.

MANY ASSOCIATIONS ACTIVE

The United States Bureau of Standards has prepared a report on standardization work in 102 trade associations co-operating with the Bureau, which has been made available, and a list of over 600 trade associations has been canvassed in the preparation of this paper. Information has been received from several score more than it will be possible, in the time allotted, to fully acknowledge. It is, therefore, with regret that the accomplishments of only a small number of associations which have done admirable work in engineering, can be described this evening.

So great has the importance of association work in general become that the first building to be built in New York City, after the war, is the twenty-story National Association Building, especially designed to accommodate the many association headquarters centered in New York City.

The public at large, and even the engineers who deal more particularly in materials may not realize the broadmindedness of the manufacturers of the United States. Many do not know that the members of these associations will send their own factory experts to the brother manufacturer's plant to assist in the better production of a competing material. They do not realize that through these associations, the improvements made by one manufacturer are immediately available for all other manufacturers.

At First it would seem absurd to expect a manufacturer who has learned to prevent efflorescence, let us say, in a certain product, to give this secret to his competitors, and it did take broadmindedness to see the personal advantage in so doing, although it would be immediately granted, that the advantage to the general public is great.

One reason why such acts are frequent, is because the manufacturer who becomes imbued with the association spirit, discovers that the best thing he can do for the sale of his own product, is to have the general public realize that the material is one not subject to drawbacks when manufactured by anyone, and is a safe and proper material to specify. He realizes that he cannot get one hundred per cent of the business, and it is better for the public and for him to take his chances in getting a smaller percentage of a larger industry which is not held back because of poor manufacturers.

Double dependence can be placed upon the products of Association members—the seller has his own reputation at stake, and all his competitors will see to it that their product is in no wise discredited by inferior workmanship or materials sold by others.

This world is a small place to live in and the advantage and friendly spirit generated by co-operation react to the benefit of all concerned.

HOW ASSOCIATIONS ARE ORGANIZED

The typical organization of a trade association consists of representatives of each member company. Some of the associations have but three or four members, others have as many as fifteen hundred or more members. The members of the smaller associations naturally have closer contact with the activities of the association office than it is possible in associations where the members are greater in number. In the latter event, however, an Executive Committee of workable size is usually elected at the annual convention. These smaller bodies meet frequently and direct the work of the secretary or executive in active charge of the associaion.

Information as developed, from time to time, is supplied in bulletin form to the member companies and the public with more or less elaborateness, depending upon the funds available.

The funds for association work are usually contributed in proportion to the volume of business transacted by the various members so that the cost of the association work is covered in proportion to the benefits that the member companies may derive from it.

No body of men can meet from time to time, and, as it were, "put their feet under the same table" without finding that their competitors are human, like themselves, and realizing that the same general policies are beneficial. It is quite probable that in the past the tendency toward secretiveness in industry has been a drawback to broader co-operation and has often been a detriment to the advancement of many industries.

The best impulses that we have are kept back by the fear of each other. Trade organizations minimize that fear. No two men can have just the same identical experiences in any line and interpret them the same way. Trade organizations bring men together and each is the richer for it and all who hear them discourse on their special topic find something to aid them in theirs.

This is well expressed in a recent editorial in *Engineering News-Record,* congratulating the public on the formation of the Asphalt Association.

"The advantages that accrue from association work flow chiefly from the consequent enlarged viewpoint which the individual members take of their opportunities and of their responsibility to the public and that special branch of it which they serve. Selling problems, which naturally dominate the individual company when left to itself, are tempered with a new and higher ideal of service, even though the company has hitherto given much thought to service to its customers. The same raising of standards has been noted in the metal-lath, the lime, the cement, the brick and other industries. The reason for it is not hard to find. When proceeding alone, the selfish motive naturally comes to the fore. When an association is formed and progressive American business men discuss their mutual problems, the greatest good of the greatest number is sure to dominate and control policies—and that requires the rendering of a very superior service. As one bit of evidence in support of this view, one needs only to recall that practically every industry upon the formation of a promotional association has established a research laboratory in which the general problems of the industry and of the given field are studied. It does not assume the research work of the individual companies, but takes up the broader problems. Such study is certain to benefit the given field and the public in general.

Another benefit that always follows in the wake of promotional associations is a recognition of the limitations of the product. A company cannot profit over a long period of years by selling its wares for uses for which they are not fitted. Yet that very practice is found in many industries. The progressive companies refuse to indulge in it, and when association work is established their views—the higher standards—dominate.

Nor are the benefits to be deprecated merely because such procedure happens at the same time to be "good business." In fact, the rendering of a superior service should properly be attended with higher rewards to those who give the service."

PUBLIC SERVICE RENDERED

A great opportunity offers itself for public service in connection with the important work of such societies as the *National Fire Protection Association, The American Concrete Institute, American Society for Testing Materials,* and many others. Various conflicting industries must be represented upon the committees studying great public questions, or else the commonwealth will not get the benefit of the melting of the many arguments into standard practices. While representatives of individual concerns are often members of these committees and render distinctive and arduous service, it is nevertheless a hardship on their concerns which should not exist, but which should be spread over the entire industry.

Most of the problems before these public organizations are primarily engineering in nature. Representation by an association gives even the smallest concern an opportunity to serve the public where the expense would prohibit individual participation.

Most of the engineering work in these Associations has been done by the office of the Association itself. Occasionally, however, the lack of engineering talent in the organization has dictated a policy of employing an engineering organization to conduct research and develop the needed information. So insistent has this demand been recently, in the building industry, that the Structural Service Bureau of Philadelphia, has been organized for this specific work and has already rendered service to the Slate, Common Brick and Encaustic Tile Industries.

COMPETITION AND CO-OPERATION

Sales are made by salesmen employed by the competing concerns and advertising is placed by the individual companies, though sometimes joint campaigns are resorted to. The most fruitful source of co-operative benefit comes from the standardization of materials; improvement in methods of manufacture; experiments on physical properties, such as fire resistance, thermal conductivity, abrasion, strength, etc.; the qualities of materials in relation to the physical properties of competing materials; methods of finishing; use of waste products; safety of the product in relation to its use by other industries, etc.

The opportunities for co-operation would present a very long list, but in analyzing them it will be found that most of them lay in lines which are pure engineering, or very closely allied.

Even those manufacturers who have decided upon definite co-operation are reluctant to have their materials or their design compared with the materials or design of some competitor and one of the most important functions of the trade association is to develop specifications, or "measures" by which the various manufacturers can test their own product and realize the improvements necessary to reach a proper standard.

ENGINEERING APPLIED TO COMMERCE

The public and even many engineers are prone to think that engineering concerns itself only with immense projects, such as building bridges and buildings, moving hills and rivers, designing machinery, and irrigation; but engineering has now been set at work in the trades, standardizing, researching, developing, and generally helping the manufacturer to improve his product, thereby giving better material to the public for the same money, or actually reducing the price.

Engineering college professors have looked askance at the dwindling number of their graduates who still practice pure professional engineering, such as civil, electrical and mechanical, but the principles they instilled, and the lines of reasoning they developed are being used just as they intended, but may be engaged in finding a new way in which all the manufacturers of one line of goods can improve their product by adopting a process devised by the most progressive one, or studying the complaints received by a group of manufacturers with a view to analyzing the causes or devise methods of removing them.

NEED FOR ENGINEERING STANDARDIZATION

Although many building material lines are organized into Associations and much advancement has been made, Mr. Earnest E. Trigg, the President of *The National Federation of Construction Industries,* in pleading for more standardization within its ranks, says:

"1. It permits the manufacture on a quantity basis.

"2. It makes it possible to produce a supply during the slack season, thereby tending to prevent seasonal employment, decreasing labor turnover and facilitating prompt delivery.

"3. It reduces maintenance cost and makes repair easier.

"4. It eliminates poor design and unsatisfactory supplies.

"5. It reduces the labor and machine costs, both at the factory and at the site of erection.

"6. It makes possible closer co-operation between architects and engineers and the men who produce, distribute and install material and equipment.

"7. It assures a uniform degree of safety and efficiency during and after construction.

"In a word, a properly executed program of standardization in the construction industry appears to point the way to a better service, from the standpoint of both the construction interests and the consumer, and to reduced cost."

With the constantly growing conditions of housing shortage, much effort must take place in this industry to stimulate construction by lowering costs through standardization. Already the time of plumbers has been reduced from eight days to four days for the installation of a bathroom through better design.

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The enormous fire loss aggravates the situation and is a broad field for study particularly in the neglected subject of the small house.

This brings out a secondary, though important benefit to the public through associations. It is the co-operation of allied associations. Where two or more materials are used together, as cement and steel, or plaster and lath, etc., it is manifestly simpler for the two industries to co-operate and give the benefit of their study to the whole country, than it would be if two companies only came into contact.

ACTIVE ENGINEERING WORK.

Among the many examples of engineering activities the following 73 are typical and cover a great field of research, development and co-operation.

The Mechanical Section of *The American Railroad Association,* Chicago, has taken over the activities of the former *Master Car Builders' Association.*

The question of uniformity in the construction of cars whereby the parts of cars used by one railroad may be used in repairs of the cars of any other road has been constantly before the Association. As an indication of what has been accomplished in this direction, the following comparison of parts necessary to keep on hand for repairs at the date of re-organization (1882) and the present time is cited:

	1882	1918
Axles, different kinds	56	5
Journal boxes, different kinds	58	5
Couplers, different kinds	26	2
Brake shoes, different kinds	20	1
Brake heads, different kinds	27	1

Among the more important developments made by the Association may be mentioned the adoption in 1887 of the automatic coupler for cars, thus doing away with the link and pin coupler and the necessity for going between cars to couple cars together. It may be said that at the present time it is the universal standard of all the railroads in the country.

Another noted achievement was the adoption in 1888 of the automatic air brake as the standard of the Association. Today, practically every car in the country is equipped with this device.

Following its adoption, a code of instructions for the proper operation of the air brake has been prepared and generally distributed among railway employees.

Through the activities of the different committees and their investigations and studies, standards for 63 different parts of cars have been adopted by the Association.

The railroad car of today is simply a vehicle of transportation, no matter by what railroad it is owned. The object of the railroads today is to furnish a vehicle suitable for the lading and transport that lading to destination as expeditiously as possible. The railroad car is subject to very severe handling in trains and certain defects naturally develop which need to be kept in repair.

To take care of this condition, this Association has formulated and maintains rules for the interchange of traffic in so far as they relate to the physical condition of th ecar, so that the traffic itself may not be delayed. By these rules of interchange the immense movement of traffic between railroads is carried on with a minimum of delay due to the defective condition of the car.

The efforts of the Association through these interchange rules are:

1. To establish rules which will uniformly permit of the prompt interchange of traffic between the various railroads without undue delay to the shipment on the car, which might be brought about by a difference of opinion between the receiving and delivering line as to responsibility for the physical condition of the car or the method of loading on open top cars.

2. To provide through allowances, as given in the rules, prices to be charged for materials, detail times for completing the various items of repairs and a uniform labor rate per hour for same.

3. Uniformity in compiling charges as between car owners for the maintenance of the equipment of the country.

4. Fixed allowances to enable car owners to properly check bills for car repairs made against them by other handling companies.

5. To provide methods for reimbursing car owners for the destruction or damage to their cars by othher handling companies.

6. The compulsory use by car owners of detail standards of construction as brought about through the operation of the rules, so when the Association feels that certain standards of construction are necessary for the safe operation of cars, they will not be permitted to be interchanged without the use of said standards.

7. In 1887 an Arbitration Committee was established for the settling of disputes arising under the rules between members of the Association in reference to a correct understanding of the rules with reference to car maintenance and also as to correctness of charges. During this period 1133 cases have been arbitrated.

The Association has promulgated rules for the loading of materials on open cars, thereby preventing the shifting of loads in transit and the consequent accidents therefrom.

The safety appliances approved by the Interstate Commerce Commission are our standards and their rules governing same are distributed to our members.

The Association, working in conjunction with the Bureau of Explosives, has developed a series of specifications for the construction and operation of tank cars. The first specifications were prepared in 1903, and were principally for wooden underframe cars having tanks tested to but 40 lb. per square inch, and, therefore, under the Interstate Commerce Regulations could not be used for the transportation of inflammable liquids with flash points below 20 degrees Fahrenheit.

The next step was the development of a tank car for the handling of volatile inflammable products, to withstand a test of 75 pounds per square inch.

The final development is a tank car for the transportation of such liquids as chlorine and sulphur dioxide, to withstand a test of 300 pounds per square inch.

Tests of these tanks and their safety valves must be certified to the Bureau of Explosives before they are permitted to be used in service.

In 1909, through co-operation with the *Master Car Builders' Association* (now a part of the *American Railroad Association*), *The Association of Manufacturers of Chilled Car Wheels,* Chicago, was enabled to reduce the existing great variety of car wheel patterns to three standard patterns for 30-ton, 40-ton, and 50-ton cars. In 1917 an additional pattern for 70-ton cars was adopted. Uniformity of product has been greatly facilitated through this uniformity in design. The wheels made according to these standards are subjected to the Master Car Builders' tests for strength and chill before acceptance.

Research on heat stresses in car wheels is being conducted at the Engineering Experiment Station of the University of Illinois and at the Bureau of Standards.

In 1917 *The International Railway Fuel Association,* Denver, made "Tests of Six Grades of Coal from a Franklin County, Illinois, Mine," at the locomotive laboratory at the University of Illinois. Those tests were made on a co-operative basis.

The Paint Manufacturers' Association at Philadelphia has developed an educational bureau which has been brought by successive steps from the bureau of promotional development and from the advertising committee.

From time to time the paint industry has been menaced by a shortage in flax crop. Whenever this condition recurs, legitimate and intelligent as well as illegitimate attempts actuated by ignorant cupidity have been made to utilize or substitute other vehicles. The facts are at once a promise and a menace to the trade in the hands of the unscrupulous "Oil Doper." They become a menace whenever the price of linseed oil rises. In the hands of the conscientious paint technologist they promise both a reserve for emergencies and in the raw materials for new paint specialties.

The idea that the paint and varnish industries might do something to prevent the threatened abandonment or destruction of the American Flax Crop originated with the Educational Bureau, in 1907, when the menace of the then-existing situation was brought sharply to the attention of the trade by a failure of the crop.

No more effective work has ever been accomplished (not even by the German government) in behalf of any industry than this work for the paint industry of the United States. The committee has wisely contented itself with selecting the men who understand the subject and supplying them with the necessary funds for educational work among the flax growers. The result is an achievement that cannot be minimized, and is a credit to Agricultural Engineering.

The work with miscellaneous oils was commenced during the period of very high priced linseed oil.

Early in the investigation it was considered advisable to interest the American farmer in the cultivation of soya beans. Up to the present time all of the soya bean oil used in this country has been imported.

Drs. Allerton S. Cushman and W. H. Walker announced to the American Society of Testing Materials, certain important conclusions regarding causes of corrosion of steel and the former detailed certain experiments indicating the possibility of preventing the most prevalent form of corrosion by use of pigments of the basic or chromate type which would inhibit corrosion through their property of rendering iron passive. At this point the Educational Bureau suggested a field test of the theory on a large scale. The proposition was accepted and a steel fence test was erected under the supervision of the society, the plates for the test being contributed to the bureau by the United States Steel Corporation and the American Rolling Mills Company. The test was instituted to determine whether certain pigments tend to retard the others to stimulate the corrosion of steel. In the judgment of the Bureau the fact that they do has been amply demonstrated.

The original Cushman theory has been widely accepted as demonstrated and the principle has been largely adopted by paint manufacturers of priming paints for steel and iron.

Concrete and cement have come into general use as building materials. For many technical reasons as well as for reasons of taste, it is coming to be realized that they should be protected and beautified by paint. Special coatings, some of them patented, have been offered for the purpose.

In 1912, *The National Fire Protection Association* instituted a campaign against the use of wood in general as a structural material, and several southern cities passed ordinances prohibiting the use of shingles for roofs. The Bureau got in touch with the lumber associations and their technical experts with an offer of co-operation, which was gladly accepted. A series of tests was instituted and a preliminary report was made thereon. Later work advocating that a painted roof does not take fire from fire-brands, cinders, etc., a tabloid was issued on the subject.

Research in connection with paint vapor demonstrated the disinfectant quality of paint and disclosed the real cause of the ill effects sometimes experienced by sensitive persons in freshly painted closed rooms, and showed how these effects can be avoided by proper ventilation.

The work comprised a vast amount of detailed original study. It involved, among much else, the following:

METHOD OF PREPARING PAINT FILMS.—The method developed by the Section gave a much better film than ever produced before.

MACHINE FOR TESTING PAINT FILMS to determine their relative elasticity and shearing strength, etc.

METHOD FOR EXAMINING MICROSCOPICALLY THE STRUCTURE OF VARIOUS PAINT PIGMENTS, measuring the size and studying the characteristics thereof.

A STUDY OF THE VARIOUS PIGMENTS, which led to the formulation of the law of Voids in the manufacture of paints.

THE MAKING OF PHOTOMICROGRAPHS.

DETERMINATION OF VISUAL AND ACTINIC OPACITY OF VARIOUS TYPES OF PAINT PIGMENTS when ground in vehicles.

SETTING UP OF A SERIES OF CAN STANDARDS to harmonize and systematize practice and to eliminate certain abuses.

PUBLICATION OF A CHART GIVING THE CHARACTERISTICS AND NOMENCLATURE OF PIGMENTS AND VEHICLES USED IN PAINTS.

THE EXCLUDING AND RUST INHIBITING PROPERTIES OF PAINT FILMS.—In this were described two original types of apparatus for determining the moisture and gas excluding properties of paint films.

A study of concrete paints, with suggestions which would aid manufacturers in making their own tests and in designing protective paints for concrete.

A study of iron oxides obtained in this country and abroad, showing analysis and tinting value.

The designing of special apparatus for determining the toxicity and antiseptic properties of paints and paint vapors. This was new and constructive work.

The attention of the engineering world has been called from time to time to the disastrous results consequent upon the electrolytic corrosion due to escaped currents passing through steel imbedded in concrete. Professor W. H. Walker had shown, in a paper to the A. S. T. M., the relative insulating efficiency of different coatings. The subject has been taken up for exhaustive study by the Scientific Section in a research now in progress with hundreds of test-cylinders of cement. The results thus far are most encouraging.

The National Varnish Manufacturers' Association, New York, has a Fire Prevention and Ordinance Committee and a Plant Managers' Committee, which has to do with technical and safety matters. There are also representatives of the Association on the Joint Flash Point Committee and on the Central Fire Insurance Committee. The Association has also issued bulletins on the U. S. Standard Gallon, on Varnish Specifications of the Government and Varnish Specifications of the Signal Corps.

The Shellac Association of New York was formed for the protection of Shellac importers, and covers everything necessary with the importation of goods up to the point of distribution. They have adopted methods of analysis, methods of sampling, and penalties for anything of adulteration in Shellac. They arrange for arbitration matters, and, in fact, through friendly intercourse discuss anything pertaining to the methods of handling Shellac.

The American Gas Association, New York, through its Technical Section, carries on its work through committees which for the present year, consist of:

Carbonization, Cast Iron Pipe Joints, Cast Iron Pipe Standards, Chemical Committee, Consumers Meters, Electrolysis, Refractory Materials, and Manual of Standard Practice.

The Principal standardization carried on by the Chemical Committee last year has been the revision of the Gas Chemists' Handbook. This book is the result of four years' standardization by chemists in the gas industry, coke oven and coal tar by-products industry and embraces all methods of analyses and apparatus used in gas company laboratories.

The Cast Iron Pipe Standards is a standing committee to pass upon any necessary changes in the Standard "Specifications for Cast Iron Pipe and Special Castings," adopted by its predecessor in 1913. These standards were the result of the combined work of gas engineers and pipe manufacturers and are universally observed in the industry, with great saving both to manufacturers and users.

The Cast Iron Pipe Joints Committee has been chiefly engaged in the design of a standard all cement joint for all sizes of cast iron mains. This has involved considerable laboratory experiments to determine the strength of bond and shear of cement in joints and a study of the stresses to which pipes are subjected underground. The Committee is now prepared to submit a tentative alternate standard bell for use in all cement and combination joints which, if adopted, will save the expense to manufacturers and pipe users resulting from the varying specifications of individual engineers. Should this prove satisfactory in practice the use of the all cement joint will alsa have an important bearing on the mitigation of electrolysis.

The Refractory Materials Committee has been working on standard tests and performances of refractories in coal and water gas manufacture and has been in active co-operation with the Bureau of Standards, the Refractory Manufacturers' Association Committee, and Committee C-8 of the American Society for Testing Materials. This Committee some years ago issued a Bibliography of Refractory Materials and a report of standard specifications covering fire clay and silica material for gas works' use, more especially material for carbonizing chambers and the refractory qualities of such material. This report received a wide distribution among the members of the Association.

The Carbonization Committee is appointed each year to keep in touch with developments of carbonizing methods. Particular attention is paid by the Committee to carbonization through coke ovens.

The Electrolysis Committee has been actively co-operating with the Bureau of Standards and has had representatives on the Research Sub-Committee of the American Committee on Electrolysis. This Committee keeps in touch with the general situation and each year submits a report on development in methods of mitigation.

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Engineering has played a very important part in *The Gas Products Association,* Chicago, Ill. This Association is made up of electrolytic oxygen and hydrogen manufacturers, and embraces practically all the large commercial plants in this country. The industry is a comparatively new one and in the past a few fatal accidents brought a flood of criticism on their method of gas making.

They realize that it is absolutely essential to observe certain rules regarding the proper method of installing and operating electrolytic plants and accordingly, a committee of engineers have prepared a set of plant standards which embody all the necessary precautions which must be observed in plants. By means of these standards plant operation is virtually made automatic and every possibility of danger is eliminated. This will insure the industry against the cheap promoter, the careless plant operator and other such menaces to success. These standards have been adopted by the members and they believe this to be a great thing for the development of the electrolytic business.

The Compressed Gas Manufacturers' Association, New York, has a Test and Specification Committee, and from time to time special committees, as during 1918, on Valve Seats, Navy Specifications, etc. It has under consideration the advisability of the standardization of valve outlets and of colors of gas cylinders. Cylinders are manufactured and tested in accordance with Interstate Commerce Commission's regulations and specifications.

BUILDING MATERIALS.

The Association of American Steel Manufacturers, Pittsburgh, was pioneer in the adoption of standard specifications for structural and boiler steels and for concrete reinforcement bars rolled from billets, and these specifications were the basis of the specifications later adopted by the American Society for Testing Materials.

In September, 1916, an arrangement was entered into for cooperation between the *Portland Cement Association* and the Lewis Institute, Chicago, under the direction of Professor Duff A. Abrams in developing new information on Concrete. The research work was carried on at the Institute but the financial support came from the Association, the whole being in charge of an advisory committee. Under this union 70 very important series of tests on concrete and aggregate have been conducted. In addition to these there are a great many physical tests in concrete materials which were carried out in connection with these series, and are incidental to their correct development.

The results of the tests on the work in these series have been combined, and described in several printed papers and reports. These follow:

Tests of Reinforced Concrete Fence Posts.
Aggregates for Concrete Roads.
A Method of Making Wear Tests of Concrete.
Effect of Method of Capping on the Strength of Mortar.

Effect of Excess Water in Concrete.

Effect of Fineness of Cement on the Strength of Mortar.

"Fineness Modulus" of Aggregates.

In addition to these reports, the Laboratory has likewise issued the following eight bulletins, which, to a great extent, combine the results of practically all the recent work:

Design of Concrete Mixtures.

Effect of Quantity of Mixing Water and Curing Conditions on the Strength and Wear of Concrete.

Colorimetric Test for Organic Impurities in Sands.

Effect of Pressure on the Strength of Concrete.

Effect of Fineness on the Strength and Other Properties of Cement.

Effect of Time and Mixing on the Strength of Concrete.

Experimental Studies in Concrete.

Wear Tests of Concrete.

One of the greatest services rendered by this efficient Association has been to thoroughly advertise their findings so that they have been quickly available to everyone.

The Concrete Mixer Association, Chicago, has undertaken the standardization of the rating and capacity of concrete mixers; also the nomenclature of the machines and their parts. This will, undoubtedly, lead up to a further standardization of equipment and there is in the hands of the Standardization Committee a number of recommendations, which, if reported favorably, will standardize the extra equipment furnished with machines.

This sort of co-operation has the direct effect of stabilizing the industry and discrediting superfluous claims in advertising.

The National Association of Sand and Gravel Producers, Indianapolis, Ind., has started the work of the Engineering Department by conducting a series of tests, which they expect to use as a basis for drawing proper specifications for the use of sand and gravel. Heretofore, specifications for sand and gravel concrete have been adopted largely from specifications covering the use of crushed stone, which is an essentially different product.

The department will also undertake to develop new uses for sand and gravel, especially in the way of utilizing certain grades of material, particularly the smaller sizes, which, in many sections of the country, are now waste products.

This Association has a great field in connection with the recent discovery by Walter A. Hull of the U. S. Bureau of Standards that silicious gravel concrete is made safe, when exposed to fire, if expanded metal mesh surrounds the columns. For the past few years this material was under a suspicion which can now be justly removed by publicity.

By standardizing the diameters of shafts and heads of column forms for round concrete columns the *Metal Form Association,* Cleveland, Ohio, have enabled member companies to carry on business with one-half of the stock of forms formerly used which, of course, has enabled them to reduce the price to the contractor and insured a quicker delivery.

The shafts of the column forms are now made in diameters starting from twelve inches in even two-inch multiples up to fitfy-four inches in diameter, and the heads are made from forty-two inches in even six-inch multiples up to seventy-two inches. Before this standardization took place, architects designed in odd inches and with heads of varying diameters.

When the *American Concrete Pipe Association,* Chicago, was first formed in 1908, it was realized that some recognized standard for manufacture or an authorized specification from a recognized society would be necessary for the welfare of a new product such as cement drain tile. The American Society for Testing Materials was interested in the subject and appointed a committee known as Committee C-6 to make standard specifications for both cement and clay drain tile. This task involved a great deal of experimental work and when completed formed a basis for the standard specifications of the American Society for Testing Materials on drain tile, which have now become so well known and which are gradually coming into general use.

The second and more difficult problem was the adoption of standard specifications for concrete sewer pipe. In a similar way, the proposition was taken before the American Society for Testing Materials because the members realized that the making of specifications and standards, applying to the manufacture of various classes of pipe, should originate in and come through engineering organizations. Standardization was necessary because of economic reasons, which are almost self-evident, it being readily seen that the thickness and detail dimensions, shape of bell, width of socket, etc., could not be changed at the whims of various classes of users, except at considerable expense, which might be considered waste.

Third class of pipe on which standardization has been attempted is concrete culvert pipe for two distinct classes of service —railway and highway. The Pipe Association has a committee of manufacturers working on this subject, and after one year of study, the conclusion was reached that this was a problem on which they should have the co-operation of the engineering organizations. It was decided to invite several other national societies who are mutually interested in this problem to co-operate on a Joint Concrete Culvert Pipe Committee for parallel study of the subject. This Association took the initiative and invited, as co-operators on this committee, the following national organizations, all of which are of engineering nature:

American Concrete Institute.
American Railway Engineering Association.
American Association of State Highway Officials.
American Society of Civil Engineers.
American Concrete Pipe Association.
American Society for Testing Materials.

All of the societies have responded and with one exception, two members of each society have been appointed on this committee, and the work has already begun.

The fourth class of pipe manufactured by the members is concrete pressure pipe, but this has not involved enough manufacturers as yet to make any attempt at standardization possible or necessary.

Early during 1919 the *Gypsum Industries Association,* Chicago, organized a division of engineering. This division has prepared specifications in conformity with present accepted standards of engineering and architectural practice which cover the following:

Gypsum, Raw and Calcined, for Structural and Commercial Purposes.

Gypsum Plasters of all kinds.

Gypsum Partition Tile for the Construction of Non-Bearing, Fireproof Partitions, Enclosures, Furring, and the Fireproofing of Steel Columns.

Gypsum Plaster Board for Incombustible Lathing Purposes, Soffit Ceilings, Vent Ducts, etc.

Gypsum Wall Board as an Interior Surface for the Walls and Ceilings of Ordinary Joisted Constructions.

Reinforced Structural Gypsum for the Construction of Fireproof Roof Decks, Fireproofing Unit Shapes, and Similar Purposes.

The Association has recently created a fellowship in the United States Bureau of Standards. It is intended that the Association's representative will continue scientific investigations upon gypsum products which were started by the Bureau of Standards some time ago. These investigations will include extended possibilities in the use of gypsum for structural and decorative purposes.

A standing committee of the American Society for Testing Materials known as "Committee C-11 on Gypsum" is divided into five Sub-Committees whose duties involve research work and the adoption of specifications on the following:

Gypsum for Various Uses, Gypsum Plasters, Structural Gypsum, Testing Methods (for gypsum), Nomenclature.

Probably one of the most important and promising developments taken up by this Association is the establishment of a Department of Agronomy, under the direction of Dr. Wm. Crocker of the University of Chicago. Under the direction of this scientist gypsum is being again recognized as a valuable fertilizer material and much literature supporting such a claim, together with the necessary authentic data, has been published in many of the various agricultural journals.

A great number of demonstrations are being run in various parts of the United States this year to show the value of gypsum as a fertilizer on alfalfa, clover and other leguminous crops. Besides several other matters to be developed, an attempt is being made to work out a method of telling whether a given soil is in need of sulphur addition for the maximum production of these crops. Up to date the most promising indication is that clover or alfalfa grown upon soils deficient in sulphur will contain little or no free sulphates, while the said crops grown on soils which are rich in sulphur will have considerable free sulphates. If this method is as good as it promises at present, one could simply analyze a portion of a clover or alfalfa crop from any given land and decide on whether gypsum is needed for the maximum production of these crops on the land.

The Lime Association, Washington, D. C., in 1910 adopted Standard Specifications for Lime drawn up by its Committee on Standard Specifications for Lime and assisted in securing the adoption of the standard lime barrel law. It was instrumental in securing the formation of Committee C-7 of the American Society for Testing Materials.

The *Associated Metal Lath Manufacturers,* Chicago, have made a thorough engineering study of their material and its relation to other building materials, particularly plaster and cement. Fire tests have been conducted in various parts of the country and at the Underwriters' Laboratories. In this field very definite study is being made to develop better methods of protecting lumber and in this way to aid the conservation of the resources of the country.

The so-called fireproof building has received much consideration in the past but the small house has been neglected. Metal Lath is being especially studied with a view toward the best service it can render in concrete as well as wooden houses. The same engineering idea that dictates the greater protection of the most vulnerable parts of a battleship is being applied to the dwelling house construction with a view toward obtaining the maximum amount of fire protection with the minimum of expenditure.

The effect of painting metal lath has been studied through weather tests in several parts of the country and the processes of all the competing companies has been made available. This product will now be given a protective coating far superior to that which has been known in the past.

The subject of sound insulation in commercial partitions has been developed through experiments at the University of Illinois, bringing out some radical departures from previous accepted ideas on this subject. An exhaustive test on Thermal Conductivity of exterior walls has been made by professors at Armour Institute of Technology with a view to improving the heat insulation of small houses. These tests have brought out facts which will be used to combat unsupported claims of competitors and has also taught the member companies how to most economically insulate houses built of their material.

All of this data is made available to the public and the building profession by bulletins.

In the Common Brick industry, there has recently been a conservation development of considerable importance. Occasionally a million bricks will be discolored from the ordinary run, due to longer burning or accident. It has been discovered that these bricks, which the contractors used to throw away, are harder and can be laid up in a very attractive manner and will break the monotony of a common brick wall. Already architectural campaigns are being conducted to familiarize localities with the stability and beauty of this formerly wasted product and a housing development of 175 homes is under way in Chicago, using this material. *The Common Brick Association* is studying the standardization which will effect 250 manufacturers producing 3,000,000,000 common brick per year.

The Clay Products Association, Chicago, has done active work.

In the interest of Vitrified Clay Drain Tile, they have for several years co-operated with the Iowa State College of Agriculture and Engineering, and have donated material for testing purposes. The experiments carried out at this college at Ames, Iowa, supplemented by the work of their own physical laboratories, have resulted in the discovery of an accurate formula for earth loads on drain tile in ditches. Besides resulting in a general and very beneficial unification of vitrified clay drain tile, this formula is the adequate means of preventing the breakage of tile in ditches, and forms the basis for the required test loads mutually adopted by the Association and the *American Society for Testing Materials,* co-operating in Committee C-6 of that organization.

In the interest of Vitrified Clay Sewer Pipe, they have been continually represented on Committee C-4 of the American Society for Testing Materials, in which committee they have mutually arrived at a standard recommended practice for laying vitrified clay sewer pipe, and have proceeded far towards the adoption of a complete specification for the pipe itself, as far as its physical characteristics are concerned. The next objective, the preliminary steps for which have already been taken in Committee C-6, is to establish a standard specification for sewer pipe of every sort, covering the chemical requirements which the corrosive nature of sewage imposes upon them—this, upon the well recognized principle that competing materials for the same purposes should be equally efficient, economical and dependable for that purpose.

In the interest of Vitrified Clay Pipe Culverts, engineers of the Association have evolved a standard design for road culverts, which, by the reduction of masonry in the head walls, makes a long culvert, giving plenty of uninterrupted space in the road, actually cheaper than a short one which restricts the roads at the most dangerous points. This design, adopted as a standard by the Association, is now being presented to students of road building at universities and to associations of highway engineers and highway officials.

In the interest of Fireclay Flue Lining, they have always worked in co-operation with fire prevention organizations, who, recognizing the fact that defective chimneys are the greatest single source of fires, are always ready to co-operate.

At present the Association is in correspondence with the Engineering Department of the National Board of Fire Underwriters, with the object of producing a new code covering the details of standard chimney construction with fire resisting linings.

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The Hollow Building Tile Association, Chicago, has been instrumental in the creation of standards so that

> The manufacturers themselves know of the standards to work to in producing the right kind of tile.
>
> The engineering department has prepared and is ready to submit to the various building commissions a Standard Building Code, which protects the users of tile in any community from poor tile construction.
>
> It has prepared and has issued to the building public a handbook on hollow tile construction especially for architects and engineers.
>
> It also has prepared and issued a builders' manual, being especially prepared for the small contractors.
>
> The engineering department is prepared to become consulting engineers as to the proper use of building tile to the architectural and contracting professions.

The Steel Sash Manufacturers' Association, New York, has effected a standardization of 23 types for stock sizes, which have been adopted by all the member companies and are now carried in stock throughout the United States, insuring prompt delivery and enabling the architect to design standard openings and still obtain competition from several companies. A year ago there was no standardization and at the present time 60 per cent to 70 per cent of steel sash is standardized, effecting an economy to the general public and widening the market for the manufacturers.

ROADS AND PAVEMENTS.

The principal efforts of *The National Paving Brick Manufacturers' Association,* Cleveland, have been along educational lines and necessarily involved important matters of engineering. The Association has encouraged and developed many matters in economic production which relate purely to mechanical engineering. On the other hand, it has been necessary to employ in many manufacturing problems, chemical engineers. In both these respective efforts it has often engaged the time and services of special committees to whom is consigned special work. Sometimes they have been obliged to employ special engineers, but generally some member of the committee chosen for particular service has been an engineer.

Prof. Orton, Ceramic Engineer, and at one time Dean of the Engineering Department of Ohio State University, has co-labored with and brought out through a long study, the effects of carbon in the burning of clays. The research work in this particular has been of great advantage in the production of high quality paving brick.

The work of Messrs. Blair and Orton in the study of the Rattler test for paving brick involved remarkable research work in order to provide this experiment of measuring quality which was subsequently submitted to the American Society for Testing Materials which was approved by that Society.

The Western Paving Brick Manufacturers' Association, Kansas City, cites many instances in its industry where engineering has been the principal factor in connection with improvements in the manufacture of paving brick. The standard rattler test for paving brick was developed entirely from the manufacturers' end and has been adopted by engineers over the United States as the standard practical method of testing paving brick; the change from the small size brick to the standard brick block, and the standardization of size are other instances. One of the best examples of the value of engineering work undertaken by the manufacturers is the development and adoption of the Vertical Fiber paving brick in Western territory. This brick in all its features was the result of two to three years of experimenting by a well known ceramic engineer at various manufacturing plants in Kansas and was adopted as a standard in 1912.

The development and use of asphalt filler in preference to cement grout filler, has been entirely due to the efforts of engineers employed by the manufacturers. This Association, in common with other associations of like character, have insisted that all of the manufacturers render service of the highest type to the municipalities and counties using their product and that the quality of their product be not allowed to fall below a recognized standard of the best engineering practice. They have also insisted upon the paving brick being incorporated into pavements in accordance with the best engineering practice.

Due to the very recent organization of *The Asphalt Association,* New York, it would be difficult at the present time to make any general summary. It is, of course, true that engineering enters into every activity of the work, and prominent highway engineers are connected with the Association in its general offices and as district engineers throughout the United States.

They have in process of preparation standard specifications for asphalt purposes. The Research Department, in charge of Mr. Prevost Hubbard, formerly Chief of the Division of Tests and Research of the United States Bureau of Public Roads, will be at all times able to advise engineers as to the best standard practice in asphalt construction. The District Engineers co-operate with concontractors and public officials with the object of securing highest class of work.

Material Handling Machinery Manufacturers' Association, New York, is newly formed, but has an Engineering Committee and has been co-operating with Trade Associations such as the *Sanitary Potters' Association, Automobile Chamber of Commerce, National Electric Light Association.*

Discussion covers the various methods of "dovetailing" products of the Association into the handling problems of these other Associations, so that economies will be effected.

The Engineering Committee is also co-operating with the States of New York and New Jersey through the New York, New Jersey Port & Harbor Development Commission, covering the subject of terminal, freight and warehouse handling problems, and numbers of meetings have been held between the Engineering Committee and the engineering staff of the Commission.

The Association will also co-operate with the Society of Terminal Engineers in the definite study of cost for handling materials manually and mechanically, and the joint committees feel that some very important facts are being gathered which will show a tremendous economy effected by mechanical handling machinery.

Other general work which the Engineering Committees are undertaking is that of studying the products of all of the manufacturers in the Association which, in the case of the material handling machinery manufacturers, is an important item, as very frequently the products of one manufacturer are required to facilitate the use of the products of another.

LUMBER.

According to the *West Coast Lumbermen's Association:*

"The lumber industry has not given so much attention to the technical matters as the other chief structural materials manufacturers—cement and steel; largely, because of the fact that these two materials are in themselves manufactured products in the making of which the producers have depended largely on chemists and engineers. Wood being already a finished product in its raw state did not require this technical help in the same way, and lumbering, being a widely distributed and pioneer industry, was developed largely from a practical standpoint."

Twenty-five years ago, the practice in *The Lumber Industry* was to cut logs into whatever grades and sizes they would produce, keeping in mind at all times the idea of getting the largest possible volume of product. The lumber thus produced was usually sold "mill run" to wholesalers or jobbers who undertook to sort it for quality and sizes and to find a market for it. The development of lumber manufacturing associations has completely changed this practice.

Lumber is now graded at the back end of the saw mill plant and is put in the pile or shed in accordance with such grading according to quality and dimension. The manufacturer no longer operates his plant solely with the view to producing the largest possible quantity of material, but on the contrary, he now knows the grades and sizes which are in demand, and he is able, therefore, to operate his mill in such way as to produce a larger proportion of those particular kinds of lumber which are needed by the consumer.

The quality of the product in the aggregate has been materially raised by the establishing of standard grades. This may be made clear by an illustration. Take a 16-foot yellow pine board which contains a large defect 18 inches from one end. Under conditions prior to the establishment of standard grades, this board would have gone on the market as a 16-foot piece, but today the manufacturer knows that by cutting it to 14 feet, thereby eliminating the defect, he can raise it to a higher grade which will bring a higher price, and which will meet the requirements of some consumer who has no use for the lower grade. In consequence, he manipulates the product in the mill to produce those particular grades which consumers are demanding and to eliminate, as far as possible, those grades for which there is not an active market. The result is a larger production of the kinds of lumber most needed and larger production of the better grades of lumber, and a proportionate lowering of prices on the entire output of the plant, because of its increased merchantability.

Because of severe financial limitations the work of the Trade Extension Department of the *National Lumber Association,* Chicago, until the first of this year, when larger funds became available, its efforts were closely confined to building code work, the preparation of technical bulletins and to an effort to keep in touch with technical developments in the use of wood and of substitutes among engineers.

Since January, 1919, the association has had men in the field continuously, sometimes as many as four at one time. Thus, the National Association is no longer just watching developments in the engineering and building field, but is out making developments—so that, where wood is used, it may be used right and that wood may be used wherever it is best for the purpose.

It is now engaged in an endeavor to standardize sizes throughout the country which will be a great relief to all builders.

The Southern Pine Association, New Orleans, Research Department has conducted investigations or has initiated investigations which were designed to develop facts relative to the strength of timber for structural purposes. Also various investigations relative to the better means of utilizing wood for purposes where it is now used in the manner not most economically and also in the better preparation of timber material for the use it is particularly applicable. Investigations have also been conducted with a view of further utilization of the waste products incident to the manufacture of lumber and to extending knowledge of the utility of by-products as the result of utilization of wood waste. Particular attention has been given to the various properties of treated lumber and values of various methods of treatment and the proper place for utilizing wood of various types of preservation.

During the last four years *The Western Red Cedar Association,* Spokane, has done a great deal to standardize Western Red Cedar poles and improve their quality by eliminating by rigid inspection undesirable stock and by providing for specific minimum measurement on each length of pole.

There is a great deal of room for improvement in the methods of butt treating poles, but there is no doubt that a great deal has been accomplished and that the ultimate consumer has been saved thousands of dollars by efforts along this line.

The American Wood Preserving Association has a membership of over three hundred and since its organization in 1905 has assisted in developing wood preserving industry in this country. From thirty wood preserving plants in operation in 1905 the Association's propaganda has resulted in a growth in the number of plants to one hundred twenty-five in 1920. The wood treated by these plants now amounts to approximately one hundred thirty-five million cubic feet of which nearly 75 per cent represents cross ties. The annual consumption of wood cross ties is about 115,000,000 in number and of this quantity about one-third, or 35,000,000 are chemically treated to more than double their life in track. In 1905 when the Association was organized, the cross ties treated amounted to 14,800,000; in 1919 approximately 35,000,000, indicating an increase of 140 per cent in the period of fifteen years.

To encourage the development of the wood preserving industry, the American Wood Preservers' Association holds periodical meetings for its members and the public and publishes the experiences of those engaged in the wood preserving industry and those who use treated wood; also, formulates specifications for wood preservatives and standardizes the methods of treating material. Investigations are made by special committees appointed by the Association to record the developments in the various branches of the wood preserving industry. These committee reports are published in the Association's annual proceedings for general distribution.

The primary aim of the *American Wood Preservers' Association* is to promote knowledge of wood preservation with the view of conserving our Forest Resources.

The Association of Creosoting Companies of the Pacific Coast, Seattle, Wash., has not at the present time an engineer in its employ. Prior to the beginning of the United States' participation in the great war they did employ an engineer, jointly with the *West Coast Lumbermen's Association.* This expert was engaged in experimental and investigative work, looking to an improvement of present processes and devising of new methods; also, making various technical tests of material and treatment. The results of the work carried on by the Association were very gratifying and resulted in an improvement in the quality of the product.

Prior to the amalgamation of the various organizations representing distinctive branches of the industry into *The Associated Cooperage Industries of America,* St. Louis, which took place in 1916, consideration was given by the various organizations to the standardization of grade rules and specifications. The nature of the business is such that it was exceedingly difficult to bring about standardization. The various kinds of timber used in manufacturing cooperage material and the divers uses to which cooperage is put as containers presented a condition which naturally made for an absolute lack of any standardization until such time as the various organizations took this work in hand. Much progress has been made up to the organization of this Association and since that time there has been additional progress made along those lines until today the Grade Rules and Specifications covering all items of cooperage and cooperage material are clearly defined and respected.

In the matter of quality, a service was recently inaugurated in connection with one branch of the industry which provided for a systematic mill inspection service and the establishment of stringent grade rules and specifications to apply on material which is entitled to bear the Association trade-mark. The existing grade rules and specifications covering the product were in part influenced by scientific tests of the finished product made in conjunction with the Bureau of Explosives, American Railway Association and the Forest Products Laboratory, Madison, Wis.

Standardization, coupled with a general effort to improve the product of the box manufacturer has been the subject of constant discussion and effort in *The National Association of Box Manufacturers,* Chicago, for many years. Wooden boxes are made from one hundred species of woods in varying combinations of thicknesses and qualities, and in almost endless varieties of styles of construction and innumerable sizes. Until a few years ago, there was little scientific data available as to box construction. The Forest Products Laboratory of the Forest Service, Department of Agriculture, at Madison, Wis., have fast been accumulating information of incalculable value to the wooden box industry and to the users of wooden containers. They have installed a revolving hexagonal drum for the testing of boxes. While not duplicating the various stresses that occur to a package in transportation of products from producer to consumer, it gives some idea of the relative strength of various types of containers. In addition, they have a compression machine for testing the resistance of boxes, and hence, also the relative strength of containers.

In addition to the box testing, a great deal of other research work has been done at the laboratory developing the relative strengths of the various species of wood, the effect of kiln drying, the question of nailing, the use of metal straps, the effect of knots and knot holes upon box parts, the use of glue, etc., and so on.

The Association has closely co-operated with the laboratory for a number of years. In fact, the first box testing machine was built by this Association and was presented to the laboratory. An effort is being made to bring about the standardization of wooden boxes, by co-operating with the Railroad Administration in drafting standard specifications which will meet manufacturing and commercial conditions all over the United States, and will, without increased cost to the user, provide for containers scientifically constructed so as to safely undergo the ordinary hazards of transportation.

In the course of time the Association hopes that it may offer publicly to co-operate with any manufacturer in solving his container problems; and will, without cost, design boxes which are best fitted to economically and adequately afford protection. Further than this, they hope to extend their service to include the packing of commodities in the boxes, for packing is of as great importance as the box itself. All this cannot be done unless the laboratory is adequately financed, and they are now endeavoring to secure the necessary appropriation from Congress.

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MATERIALS FAR REMOVED FROM USUAL ENGINEERING CONSIDERATIONS.

The United States Conditioning and Testing Company, with laboratories in New York, Philadelphia, and Paterson, N. J., was established through the efforts of the *Silk Association of America,* New York, as a neutral agency with facilities for conditioning and testing silk. Its work has been extended to include the testing of all textile fabrics.

Standards of lengths, lacing, etc., have been adopted as a remedy for the imperfections in the filature silk skeins received from the Orient.

Studies of the classification of raw silk are being carried on and prizes for essays on this subject have been offered from time to time. Through co-operation with a Japanese Committee the requirements of the American Manufacturers are made known to the silk producers.

Rules governing commercial transactions in silk have also been adopted.

The Textile Color Card Association, New York, is successfully standardizing colors for the Textile and Allied Industries.

This standardization not only includes staple colors like navy blue which are good almost always, but novelty shades, which are standardized for the period they are to run.

Standardization in manufacturing reduces the costs for the dyer, manufacturer, retailer and eventual consumer. Standardization also tends to improve quality.

The National Implement and Vehicle Association, Chicago, devotes much time and study to the work of standardization and eliminations. During the war, in co-operation with the War Industries Board, as many as fifteen lines were analyzed and recommendations made with reference to the elimination of unnecessary varieties. There were between 100 and 200 eliminations in plow and tillage implements, a fifty per cent reduction in the varieties of grain drills and seeders and a greater reduction in farm wagons. The adoption of the standard automobile track of 56 inches for all farm wagons and trucks, replacing the old narrow and wide tracks and a number of special tracks, has been accomplished.

The Association is now considering the matter of standardizing the testing of draw bar pull and belt power of farm tractors under Government supervision.

The Soil Improvement Committee, Chicago, believe that they have made great strides in the fertilizer industry by advising some standard analyses. These are all high-grade and, therefore, they hope to eliminate low-grade goods from the market. They not only simplify fertilizer formulas, but also decrease the number of brands which are offered by the trade. All of these things are very much in the interest of farmers.

The Tanners' Council of New York, is playing an important part in the engineering of the construction and layout of our modern tanneries. In one instance by the installation of hoists and monorails, the working force in one department has been reduced about 50 per cent. A number of improvements have been made in the construction and operation of machinery so as to increase the output.

The Leather Belting Exchange, Philadelphia, has established a Research Bureau with the Mellon Institute of Pittsburgh and has installed there some large and expensive apparatus for testing belting and have had some certain work in this line.

This testing work is intended to go farther into the standardization of sizes and qualities and into a revision of belt engineering. It is a very large job and they are proceeding carefully and apparently not making the progress which might be expected, because of the accuracy with which all the work must be done.

This work is intended to benefit the members of the Exchange in improved methods of manufacture, and a better standardization of qualities, through the development of information which will educate the general public in better methods of using belting and a better appreciation of its merits.

LIGHT AND POWER ASSOCIATIONS.

The companies entitled to receive the service of the *General Electric Co., Research Laboratories,* Schenectady, N. Y., have adopted many developments of the laboratory and standardized on them. Prominent among them are:

The metallized carbon or gem filament, which resulted in an improvement in the efficiency of the carbon filament lamp to 2.56 w. p. c. from 3.1.

The development of process for the commercial manufacture of tungsten filaments, and the investigation of the processes in use in Europe resulted in the factories standardizing on processes and sizes which have continued in use with modifications and improvement to date. This development resulted in improving the efficiency to 1.25 watts per candle from 2.56 for gem lamps and 2.00 for tantalum lamps.

The development of the process for drawing tungsten wire for filaments resulted in further standardization of process and further improvements in efficiency.

The location of the use, in Europe, of chemicals to prevent the products of evaporation discoloring the bulb resulted in further improvements, possibly to an average of 1 w. p. c. from 1.25.

The development of the use of inert gas to retard evaporation resulted in further standardization and improvement in efficiency to possibly .65 w. p. c. from 1 w. p. c.

The Association of Edison Illuminating Companies, Boston, has Committees on Lamps, Metering and Service Standards, Electricity Distribution and Use, Street Lighting, Electricity Production and By-Products, together with a Standards Committee which handles all matters of standardization not covered by the special committees. The chief standardization heretofore done has been of lamps, meters, street lighting, and overhead construction.

The National Electric Light Association, New York, is doing a large amount of standardization work. This work is handled through the following sections or committees: (1) Technical Section with Committees on (a) Electrical Apparatus, (b) Meters, (c) Overhead Lines and Inductive Interference, (d) Underground Construction and Electrolysis; (2) Electrical Vehicle Section with a Standardization Committee; (3) National Committee on (a) Lamps, (b) Safety Rules and Accident Prevention, (c) Valuation Terminology (which co-operates with the American Electric Railway Association); and (4) Organization of Work Section with a Committee on Wiring (including standardization of methods of wiring).

Standards have been developed covering Meters, Transformers, Motors, Overhead Line Construction, Underground Construction, Electrolysis, Protective Devices, Switch Gears and Wiring Devices.

The Associated Manufacturers of Electrical Supplies, New York, has an extensive program of standardization work. The detailed work of standardization, together with other matters, is handled by the appropriate subdivisions, called sections, each with committees handling particular subjects, as follows: (1) Attachment Plugs, (2) Carbon, (3) Conduit (a) rigid conduit, (b) nonmetallic conduit, (c) armored conductor and metallic flexible conduit, (d) metal molding; (4) Electrical Porcelain, (5) Fan Motors, (6) Fuses, (7) Heating Appliances, (8) Industrial and Street Lighting Fixtures, (9) Knife Switches, (10) Lamp Receptacles and Sockets, (11) Line Materials, (12) Moulded or Formed Insulation, (13) Outlet Boxes, (14) Panelboards and Switchboards, (15) Signalling Apparatus, (16) Snap Switches, (17) Wires and Cables, and (18) Circuit Breakers (air, carbon and magnetic blow-out types).

The National Association of Electrical Contractors and Dealers, New York, has prepared in co-operation with American Institute of Architects, certain standard symbols for use on drawings and helped prepare the standard conduit sizes for certain sizes of wire which were embodied in the Electrical Safety Code. There are Committees on Standardization, National Electrical Code, House Wiring, Central Stations, Architects, and Engineers. There is also a Committee on the Standardization of Attachment Plugs and Receptacles.

The Elevator Industry was one characterized by complete lack of harmony before the war. Personal rivalry and sharp practices in business existed. At a meeting called by the Chamber of Commerce, the entire industry was represented by some fifty men, in a large part, owners of the various businesses. The result of this meeting fostered by the Chamber of Commerce and in connection with the War Industries Board, was that decided improvements were made in the construction of elevators, and at the present time, they are engaged in a program of standardization, which is supported by the *Elevator Manufacturers' Association of the United States, The American Institute of Architects* and *The American Society of Mechanical Engineers,* and a definite accomplishment is the preparation of the elevator code covering all classes of elevator work, which will be sanctioned by the architects and engineers and Bureau of

Standards. It has taken some three years to prepare this, and they expect to issue it this Spring as a publication of the *Elevator Manufacturers' Association of the United States,* for guidance of architects, municipalities, state boards, etc. It naturally represents the ideas of the entire industry in such a way that any of the manufacturers can operate, and the desirable feature is that it advocates betterment of conditions. On account of the importance of elevators, they feel that it will be of great value to the public.

The International Acetylene Association, New York, has committees which do standardization or related work: (1) Technical and Engineering; (2) Oxy-acetylene; and (3) Legislative and Insurance. The Association has co-operated in the preparation of safety standards for the storage and transportation of cylinders, drums and other containers of calcium carbide and acetylene and of standards for the construction, installation and operation of all appliances utilizing acetylene, oxygen, fuel gases, etc., with the following bodies: National Board of Fire Underwriters, Underwriters' Laboratories, National Fire Protection Association, Bureau of Explosives, American Railroad Association and Interstate Commerce Commission, Bureau of Standards, Steamboat Inspection Bureau, the Marine Insurance Underwriters, National Safety Council, and municipal, state and national regulating bodies.

The Association is itself contemplating getting out a set of standards on the above subjects in anticipation of the formation of the American Engineering Standards Association.

METAL WORKERS.

Through the Service Bureau, under the direction of the Committee on Foundry Methods, *The National Founders' Association,* Chicago, makes a thorough investigation of appliances to improve foundry practice—materials, tools, supplies and equipment; costs; melting, molding, coremaking and cleaning; inspection and shipping; planning and production; patterns and flasks. Periodical bulletins of its discussions and findings are issued. An experienced practical foundryman is in charge of the Bureau and his services are available to members upon request.

The Association maintains a Safety and Sanitation Bureau, under direction of a capable committee, which has made a thorough and systematic research of methods and devices for diminishing foundry hazards. The result has been a better liability classification under state compensation laws, and a gradual reduction in time and money lost through accidents. Its bulletins have been accepted as standard by many sister organizations, state labor bureaus, insurance companies, public service corporations, and industrial firms in all lines of manufacture. The Association maintains a stockroom, from which many safety devices are supplied to members at cost; the list includes danger and safety signs, safety goggles, foundry shoes, foundry leggings, first aid kits, etc.

The American Foundrymen's Association, Chicago, has been a leader in standardization work among casting manufacturers. It has urged and brought about the adoption of standard specifications for foundry pig iron, malleable iron castings, certain classes of gray iron castings, stoppers for steel foundry use, and today is agitating the adoption of standard specifications for casting allowances, colors for patterns, etc.

Among other things it has been instrumental in promoting the mixing of iron by analysis in place of by fracture which has effected great economies in the scientific practice resulting in reducing casting losses and also insures better casting qualities.

The specifications under which cast iron pipe is made for water and gas service have been drawn up by the *Cast Iron Pipe Industry* in connection with the *American Water Works Association* and the *American Gas Institute*. They were framed by joint committees of engineers and foundrymen, and while no specification is ideal, these specifications are practicable and are the ones under which the majority of water and gas pipe in this country is manufactured; and since their adoption are being closely copied by similar bodies abroad. These are the result of the joint effort of the founders and engineers.

As companies they are striving constantly to improve their product, but aside from technical manufacturing problems which would be met with in any industry and which must naturally be solved by the men in that industry, they of necessity must conduct tests of the manufactured product in connection with their customers. They have lately been conducting a series of experiments looking towards the improvement of the bell and spigot joint along the lines of resisting higher pressures without the shearing of the lead, and have conducted some interesting experiments with a specially designed high pressure bell and spigot joint which they have tested and had hold tight to 100 pounds gas pressure and up to 600 to 800 pounds water pressure.

Among those who have been most actively engaged in engineering work is *The American Gear Manufacturers' Association,* who have endeavored by means of standardization of arbor sizes, cutter sizes and pitch of cutters, together with numerous other possibilities which have presented themselves, to lower the cost of production particularly as it is connected with their overhead expense. It can be realized that if everybody engaged in the machinery manufacturing business should design his gears of different tooth forms and unusual pitches, that a great multiplicity of cutters would be demanded, and when he came to shop along from one gear manufacturer to another in getting prices to have his work done, he would find that in so many cases the manufacturer might find it necessary to make special cutters for his work that this would add continually to the cost of production, without at the same time increasing the value of the gears which would be produced.

The National Machine Tool Builders' Association, Worcester, Mass., has done a great deal to encourage its members in adopting for their individual factories modern costs and production systems and have also done a great deal towards standardizing various machines, as to their range, so that there will be less confusion than existed years ago.

In co-operation with the Safety Committee of the *National Machine Tool Builders' Association, The Grinding Wheel Manufacturers' Association,* Dayton, Ohio, has worked out Standards of Safety in the Use and Care of Abrasive Wheels. These standards have had the endorsement of the state industrial commissions and of a number of technical societies. The Association has also worked out Standard Shapes for Abrasive Wheels.

The National Association of Brass Manufacturers, Chicago, have eliminated something like twelve thousand items, inspired to a great extent by experience with the Conservation Division of the War Department of Washington during the recent war.

They are standardizing threads, weights and measures first to give the public a good standard article of a dependable kind at a reasonable price, but more particularly in these days of high cost of labor, to in so far as possible, arrange for the interchange of different makes of goods by standardizing threads and are working with Washington and the Bureau of Standardization in that line to overcome the dreadful experience that was met with in France on this very subject.

REFRIGERATION AND HEATING ASSOCIATIONS.

The American Association of Refrigeration, Chicago, has the following commissions which are engaged in standardization or research work: (1) Commission on Gases and Units, which deals with the physics and chemistry of refrigeration, (2) Commission on Testing Refrigerating Machinery and Insulating Materials, which concerns itself with matters of the design, construction, operation and methods of testing refrigerating machinery and materials, (3) Commission on Industrial Refrigeration, which takes up the use of refrigerating apparatus in the Industrial Arts, (4) Commission on Railway and Steamship Refrigeration, which considers all matters pertaining to car icing, pre-cooling, car construction, insulation and uniform regulation.

The Association has co-operated with the Bureau of Standards for a number of years in investigations of the physical properties of refrigerants.

And at the other extremity we have *The National Warm Air Heating and Ventilating Association,* Columbus, Ohio, which has a Committee on Engineering and an Advisory Committee on Warm Air Furnace Research, which supervises the research looking to increasing the efficiency of warm air furnaces which is being conducted at the University of Illinois.

Some standardization of products was accomplished during the war through the Association's War Service Committee, and Formula and Rules for Installation of Warm Air Heating, has been published by the Association.

The Heating and Piping Contractors' National Association, New York, has a Committee on Standardization. It was represented on a joint committee with the American Society of Mechnical Engineers and the Committee of Manufacturers on Standardization of Fittings and Valves, which drew up a standard schedule of flanged fittings and flanges. It also secured a uniform rating for house heating boilers.

The American Boiler Manufacturers' Association, Brooklyn, N. Y., has considerable interest in standardization work. It co-operates in this with the *American Society of Mechanical Engineers* and actively supports the Uniform Boiler Law Society.

Proposals for the standardization of pressure of water-tube boilers and of horizontal return tubular boilers were adopted in 1919.

The National Boiler and Radiator Manufacturers' Association, Geneva, N. Y., through various committees has actively co-operated with the *American Society of Mechanical Engineers* in the preparation of part 1, section 2, of the A. S. M. E. Boiler Code and helps to revise the Code from time to time as well as to secure its adoption by the States through the agency of the *American Uniform Boiler-Law Society.* There is also a Committee of the Association through which co-operation with insurance companies on matters relating to safety devices is secured.

The Magnesia Association of America, Philadelphia, was formed about three years ago to carefully investigate the subject of heat insulations and to give publicity to the value of 85 per cent Magnesia for such work.

A Technical Committee, consisting of two engineers in the employ of two Member Companies, was created, and a Fellowship in the Mellon Institute of Industrial Research, University of Pittsburgh, was secured. The Technical Committee and the Mellon Institute work in very close harmony and the results of their efforts are being given publicity by the Association in the form of advertising in trade and technical magazines, booklets, specifications, etc.

These investigations from an engineering standpoint have been especially interesting in that when the work was commenced it was quickly realized that all previous experimentation had been based on one certain type of condition, whereas, in practice, there are so many different conditions under which high pressure steam is employed that it has been necessary to do a very great deal of pioneer work in basic experimentation with bare pipes and boiler surfaces before the actual work of testing insulating efficiencies could be begun.

The function of the Mellon Institute and the Technical Committee, in addition to the above, is to standardize methods and processes of production of Magnesia, and a great deal of work has been done, and is under way, along this line.

The Asbestos Textile Manufacturers' Association also maintains a Fellowship in the Mellon Institute, designed to test and endeavor to standardize weights, qualities and uses of products made in that branch of the Asbestos Industry.

The Asbestos Paper Manufacturers' Association employs the assistance of the Mellon Institute for the purpose of experimentation preliminary to the writing of standard specifications for the use of Asbestos Paper and Millboard, particularly of the latter, in connection with insulating boiler settings and boiler walls.

Generally speaking, the Asbestos-Magnesia Industries are doing, in the individual plants of the members and collectively in the Mellon Institute, a very considerable amount of engineering work designed to discover the actual conditions under which Asbestos-Magnesia products are used and to create standards, not only of product but of practically any use by consumers.

MISCELLANEOUS ASSOCIATIONS.

The Institute of Makers of Explosives, New York, has a Committee on Standardization, a Committee on Uniform Legislation, and a Committee on National Legislation. The standardization work consists of the preparation of specifications for standard storage magazines, for minimum distances of storage of explosives from buildings and public highways, and uniform rules for the regulation of the manufacture, storage and transportation of explosives. In this work there is close co-operation with *National Fire Protection Association, National Board of Fire Underwriters* and the Bureau of Explosives; also with Committee D-10 of the *American Society for Testing Materials.* The Institute is also attempting to standardize the sizes of packages and containers of explosives.

Engineering has played a considerable part in the *Hydraulic Society's,* New York, activities and the members feel that a great deal has been accomplished in the way of standardizing and defining the various terms relating to hydraulic pumps and the accessories and equipment that are considered as part of a standard pump. For example, the Centrifugal Pump Committee has established definitions of total head, suction lift, static head, total dynamic head, total discharge head, etc.

Testing in *The Paper Industry* is a topic upon which a number of excellent articles have already been published. Much of this matter deals with paper testing in its more general aspects, and the field has been covered very thoroughly. Most of the future work on paper testing will probably be directed, therefore, to special tests of papers for specific uses.

Papers are usually studied under some, or all, of the following headings: Fibre composition and chemical tests; Fibre distribution; Nature of filler used; Nature of sizing; Thickness; Weight per standard unit (ream, etc.); Bursting strength; Tensile Strength; and Folding endurance.

This classification of tests is used by the Bureau of Standards, for instance, in the routine testing of ordinary papers.

Other indications of paper quality, which depend more on personal experience than upon actual tests, are the "rattle," "feel," color, finish, opacity, etc.

The technical work of the *American Paper and Pulp Association,* New York, industry, including standardization, is done by the Technical Association of the Pulp and Paper Industry. It is interested in any work which has for its object the standardization of the product. A standard method of testing pulp has been adopted by this Association, and this method is used in case of disputes. In close relationship with the American Paper and Pulp Association are several associations, called divisions, such as the Writing Paper Manufacturers' Association and the Pulp Manufacturers' Association, whose major problems it handles. Some of these associations are, however, interested in the establishment of standard grades of paper and related matters.

THE AUTOMOBILE INDUSTRY

The Automotive Wood Wheel Manufacturers' Association, Chicago, has an Engineering and Standards Committee, composed of the leading engineers employed by the members.

This Committee has accomplished, among other things, the following:

1. Complete standardization of spokes and wood felloes for both passenger car and truck wheels. Standard blue prints are issued, not only to members but to all sources of supply. The result is that one member's raw material in woodstock is available without change to another member in time of need, and when a customer changes his source of supply. It greatly facilitates the woodstock producers' manufacturing also.

2. Similar standardization is under way, and nearly completed, in the principal metal parts used in wheels. This has greatly benefited the metal parts producers, and similarly benefits the members. It benefits the general public also, by insuring standards in the industry that are higher than some of the practices hitherto in vogue.

3. A less extensive standardization is well under way as to the finished product. Certain minimum standards are being set by the Association, below which the members will refuse to build wheels. In other words, for a specified weight and size of car, there is a specified minimum size of spoke, felloe, and flange, below which the members will refuse to build. There will still be plenty room for individual ingenuity above this minimum, but dangerous ingenuity below safety standards will no longer be tolerated.

Engineers will appreciate, and most employers who do not have engineering training will appreciate, though possibly to a less extent, that this kind of work cannot be done in any valuable way without trained men in charge of it.

The most significant thing which *The Motor and Accessory Manufacturers' Association,* New York, have done recently is the matter of bushing standardization. Several preliminary conferences of the plain bushing manufacturers have been held recently under the auspices fo the Association to determine upon standardization of products on the following points:

1. Manufacturing tolerance standards.
2. Finish of bushings, that is, whether in quoting to contem-

plate removal of oil groove and oil hole burrs if blue prints specify bushing to be reamed after assembly.

3. Stock allowance for reaming after assembly.
4. Standard allowance for press fit.
5. Inspection standards.

The purpose being to learn the difficulties experienced by the different bushing manufacturers with their customers and to reconcile these difficulties with the most economical manufacturing practice, taking into account the limitations of the machine tools now available, the necessities of design and as far as possible eliminate unnecessary cost by adhering to limits that are nearer than is absolutely essential, making special cases of close limits, where close limits are necessary and charge accordingly, and determine by the standards which will fit in the greatest number of cases and are possible of accomplishment with the machine equipment available; educating the customer up to the best methods of inspection and best practices of design.

By the Association's getting back of such a movement, the matter can be put before the Society of Automotive Engineers or the Machine Tool Builders' Association and such other Standard Boards, in a clear-cut, authoritative manner for more ready adoption to the economical advantage of the whole automotive industry.

The personnel of the Standards Committee of the *Society of Automotive Engineers,* New York, represents the best engineering talent available and, therefore, the result of the standardization work is a crystallization of the best engineering practice.

The automobile industry is probably the best example of what may be accomplished through standardization. The Society has had for the past ten years a Standards Committee, the present one consisting of about 200 qualified engineers divided into Divisions appointed to consider certain phases of the industry. Over 250 standards which are in extensive use have been accepted during this time.

The standardization work may be best appreciated by comparing the automobile of today with what it would necessarily be if there were no standards. In other words, if an automobile manufacturer did not make use of standards, he would be obliged to make special screw-thread fittings, rod-ends, splines, bearings, carbureter flanges, and so on, for a great many parts of the machine. A prominent manufacturer of automobile parts stated that standards represented a saving of 20 per cent to the manufacturer, and you will find many prominent engineers that would place this figure even higher.

To take specific instances, we might cite the S. A. E. Standard Specifications for steels. Before the S. A. E. standardized steel specifications, each manufacturer was ordering from the mill analyses which might vary only slightly from analyses being ordered by other manufacturers for the same purpose. The result was, therefore, that practically every order meant a special heat or heats and that each user was charged with an excessive overhead to cover the special work.

As soon, however, as the steels were standardized, the mills were able to manufacture 35 steels in place of 135, more or less, and it became possible to make up steel in large quantities and to hold reserve stocks. A saving of perhaps two or three cents a pound was thereby gained.

Before standardization of carbureter flanges, it was almost impossible for the manufacturer to change his equipment without special redesigning. This meant that his available supply was limited and in case of a manufacturer being unable to supply his needs his production was crippled until he could redesign his engine to allow the use of another carbureter. With standardization of the carbureter flanges, it is possible for manufacturers to buy of any carbureter manufacturer and at the same time it permits the carbureter manufacturer to sell at a lower figure because no special designing is necessary for each application.

A FAR-REACHING CO-OPERATIVE AGREEMENT

The National Automobile Chamber of Commerce, New York, has a unique plan of co-operation which has been of great benefit to the advancement of that industry and may well account for its remarkable growth. It is almost Utopian.

The members are manufacturers of automobiles. Practically all of them have entered into an arrangement whereby there is a free interchange of patent licenses between the members so adhering as regards certain types of patents relating to the automobile. Roughly speaking, these include all patents relating to the automobile itself and to its manufacure, except design patents, patents peculiar to commercial vehicles, and patents of an unusual and radical nature.

The Agreement takes the form of an instrument known as the Cross-Licensing Agreement, which is executed between members and the Chamber, whereby the Chamber is authorized to issue licenses under that member's patents to other members who execute similar agreements.

The theory back of this arrangement is that design patents should not be included, because they relate to the characteristic appearance of the car to the buying public. Patents peculiar to commercial vehicles are not included, because it is felt that at the present time the commercial vehicle has not had such extensive use and standardization as would warrant free interchange of ideas. The reason for excluding the radical patents is obvious.

The remaining patents which are included relate to multifarious improvements that go to make up the modern automobile, which has reached a fairly standard stage of manufacture and design, and although many of these are of extreme value, as the car is standardized in every engineering research department, and as every member is striving night and day to improve the progress, it is obvious that no one factory can guarantee that its own brains will bring into being the improvements that are bound to come. Therefore, no one factory can stand out and say that it will not need the improvements developed by its fellow members. This being so, some scheme whereby there can be an orderly interchange of ideas is highly desirable, because the only other alternative is attempting to make individual trades as each patent arises, or undergo the ensuing patent litigation. The members feel that their primary purpose is to build and market up-to-date motor cars, and that this interchange of free licenses is the best way to settle the difficulty.

It has been in operation about four years and there are six years more to run. It is believed to be an entirely satisfactory solution to the conditions which apply to this particular industry. They likewise believe that similar arrangements, modified perhaps to meet particular conditions, would prove valuable in any other extensive industry.

Other things being equal, it would be quite desirable to have each patent appraised and the license fee set, but as there is no real basis for figuring what is the proper royalty for the use of any given invention, such an appraisal is unworkable. This situation was met by making the licenses free, or to put it more correctly, the consideration flowing from one member for the licenses he issues under his patents is the right to use the present and future inventions for a limited period of time coming from all the hundred-odd adhering members.

ASSOCIATION WORK REACHING EVERY KITCHEN

The National Canners' Association, Washington, D. C., has been for some years participating in a collaborative study of tin plate, with a view to being able to write specifications that will give the best service. They have learned that an increased weight of coating retards the rusting of the outside of the cans and also greatly retards the perforations of the can (and consequently spoiling of the contents) in the case of acid fruits. They are now studying the influence on the service value of the can of the varying conditions of manufacture of the steel which constitutes the base metal of the plate.

They have been actively studying the rate of heat penetration in canned foods under different conditions of sterilizing. For this purpose a form of pyrometer has been devised with which they can determine continuously, the temperature of the center of a set of cans distributed in various parts of a commercial sterilizing apparatus. As a companion piece to the study just mentioned, they have isolated the organisms from many cases of spoilage. By inoculating the spores of each organism into a number of typical foods and determining the time necessary at various temperatures to cause their destruction, valuable information in connection with the sterilizing of foods has been obtained. For the first time the cause of spoilage and remedies therefor can be understood.

A case of spoilage in canned beets is a typical illustration of the work being done. The beets were being packed in cans of three sizes, No. 2s, 3s and 10s. The contents of these cans bear to each other the approximate relation to 1, 1½, and 5. They were being sterilized in boiling water for 50, 75, and 120 minutes, respectively.

It was found that to kill the organism that was causing the trouble, required over an hour in the smallest size can and that 100 minutes was ample in the largest size can. A change in process resulted which stopped the spoilage in the smallest size can and by lessening the cook in the largest size can, really saved steam and the retort capacity in the plant.

They are also brought in contact, more or less, with engineering problems in connection with the disposition of waste. This is a subject in which there is still abundant room for improvement.

Could a better example be given of the value of a trade association to the mass of the population?

ADAPTABILITY OF THE ENGINEERING EDUCATION

It is apparent from the foregoing examples of Engineering work that Engineering minds must have planned the experiments, studied the processes and discovered the solutions.

"Engineering," as it may be broadly defined, "economically directs man power, and, by scientific design, utilizes the forces and materials of nature for the benefit of mankind." The latter phase of Engineering is most often brought into play in Trade Association work, but it must be understood that all the engineering accomplishments have not been made by trained engineers. Far from it!

Exceptional men, without an engineering course, are doing splendid work in many industries, but to find one particular course of training which will most closely cover the needs of association work, let us look toward the Engineering colleie. Here the natural endowments of the individual are guided into methods of study and analysis that are extremely valuable in this special work. The relations of materials to other materials, their economical use, the discovery of new raw materials and processes of converting them are all Engineering problems toward the solution of which the entire course is directed.

The concluding words of Professor Duncan's book, Chemistry of Commerce, may be worth recalling at the present time:

"Everywhere throughout America, wherever there is the smoke of a factory chimney, there are unsolved, exasperating, vitally important manufacturing problems—problems in glass, porcelain, starch, tanning, paints, drugs, meats, iron, oil, metallurgical products —problems wherever man deals with substance. It seems clear that these problems can best be answered by combining the practical knowledge and the large facilities of the factory with the new and special knowledge of the universities, and by making this combination through young men who will find therein success and opportunity."

Engineering education is based upon properties of materials, analysis of cause and effect, and investigation. These are three principles on which the Trade Association justifies its position without the question of a doubt. Engineering implies impartiality in the measure of products through the cold glasses of scientific observation. It teaches the basic principles upon which to depend. It has studied the unfolding of science and invention, and realizes that articles of commerce are subject to constant developments—that new ideas, however small they may seem at first, must be given full consideration, as a small idea with the basis of fact has, and again may, revolutionize a big industry. Engineering knows what is best today may not be best tomorrow; not from the standpoint of style or popularity, for these are matters for sales managers to predict, but from the standpoint of the usefullness or economy of the product itself; and it is constantly seeking material improvement.

As so ably expressed by Mr. Herbert C. Hoover when he accepted the Honor Award of the Western Society of Engineers recently, for engineering the distribution of the World's food supply:

"I could not accept it for myself because in those organizations where I have had the honor to preside there has been a large preponderance of engineers, volunteers from our own American profession. First in the Belgian Relief, then the Food Administration, then again in the Supreme Economic Council I have had associated with me first and last over one thousand American engineers. It has been the ability of these men, their capacity and constructive thought, that quality of engineers which leads them to quantative thought and not qualitative thought, is the basis upon which organization in emergency can and must succeed."

The Engineering education frequently neglects human relations—a most important element in the Trade Associations. Publicity, Psychology, Economics, Law and other similar studies are not generally covered in Engineering courses.

Such considerations as these are of great importance in this work for it is clearly up to the association manager, not only to develop new methods and ideas, but also to "sell" them to the association members and the public. In this work the Engineer cannot stop at the rendering of his report, but must see that the results of his determinations are accepted commercially for the good of his industry and the public. The commercial side is as important as the technical.

The public is apt to think that the "bookworm" or "grind" is the typical Engineering student because the public knows that hard application is necessary to graduate. But there are as many hand clasps among Engineers as among any other men. Students who take part in fraternal and undergraduate activities have an unusual opportunity for social contact with their fellows, and to develop a great appreciation of the fact that this world is full of people as well as materials.

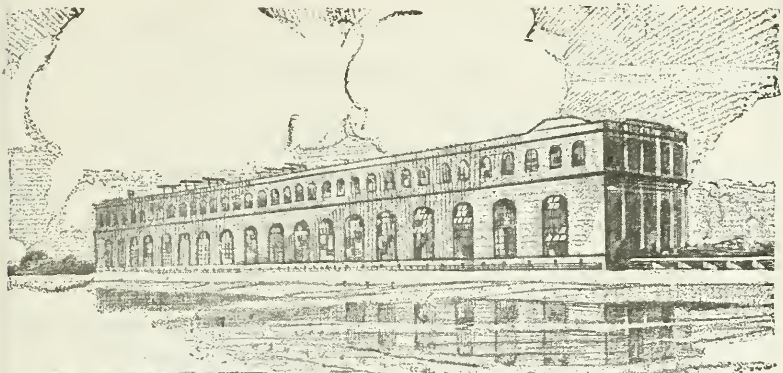
The Greek and Latin courses were not used in order to fluently read Plato or Cicero but as a "means" of education. The Engineer has been justly proud of his training, but he has considered it as an "end" instead of a "means" of education. He has been slow to branch out of purely technical work and the public considered that, as his limitation.

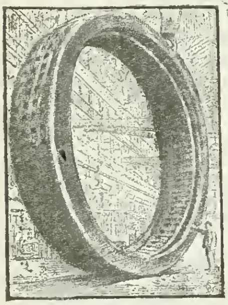
But this is rapidly changing. The Engineering education is selected more and more by those who wish to cope with the great problems of the modern material world. The Engineering education is being recognized and many corporations have adopted a policy of employing only engineers on their sales forces. Bankers and business men are now educating their sons to follow their footsteps in commercial life through a course in an Engineering College.

Where can we turn for a scheme of education that can more profitably be used to the benefit of competing industry?

We cannot expect perfection in anything, but must look for the best we can find, hoping to develop the courses and the human product where they can be of as great service to commercial life as they have proven themselves in the more purely professional fields. On the other hand, the development of the Trade Associations may develop the need of a new Profession of Industrial Engineering with its own course. This will attract students who will fill the double requirement of commercial and technical tendencies.

Engineering can be proud of the many things it has accomplished for American industry. However, it must not fail to give due credit to the broad visioned men who have financed the work resulting in truly revolutionary attainments for the benefit of manufacturers and public alike.


Mississippi River Power Company, Keokuk, Iowa



A casting for one of the huge water-wheel driven generators installed in the Mississippi River Power Company's plant at Keokuk. This installation will ultimately consist of thirty of these machines, giving a total capacity of 216,000 kilowatts (300,000 horse-power). It is the largest hydro-electric development in the world. The General Electric Company builds generators for water-wheel drive in sizes ranging from 37½ to 32,500 kilowatts and the aggregate capacity of G-E units now in successful operation is in excess of four million horse-power.

Utilizing Nature's Power

ELECTRICAL energy generated by water power has grown to be one of our greatest natural resources—and we have only begun to reach its possibilities. It mines and refines our ores, turns the wheels of industry, drives our street cars and lights our cities and towns. The power obtained from Nature saves many million tons of coal every year.

At first the field of its utilization was limited by the distance electricity could be transported, But soon research and engineering skill pointed the way to larger and better electrical apparatus necessary for high-voltage transmission. Then ingenious devices were invented to insure protection against lightning, short-circuits, etc., which cause damage and interrupt the service. And now all over the country a network of wires begins to appear, carrying the magic power.

The General Electric Company, with its many years' experience, has played a great part in hydro-electric development. By successfully co-ordinating the inventive genius of the company and its engineering and manufacturing abilities, it has accomplished some of the greatest achievements in the production and application of electrical energy.

The old mill wheel of yesterday has gone. Today the forces of immense volumes of water are harnessed and sent miles away to supply the needs of industry and business and the comforts of the home.

General Electric Company

General Office
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THE ENGINEER

In this age of transition a giant appears,
An old force that's grown mighty, the World's Engineers;
Upon them falls the work that advances mankind
And their duty, our comfort and safety to find.
Throughout the earth's progress, through all the years gone,
'Tis the Engineer's torch gave the light that lead on.

When nations reached out to new shores all unknown,
When they cut through the Tropics or sought Arctic Zone,
When they crossed o'er the desert or circled the Horn,
Through all dangers and sorrows, in sunshine and storm—
In the battle with Nature's wild moods everywhere,
'Twas the Engineer's Standard they found flying there.

When the War clouds low-hung at last broke o'er the World
And the legions of death their black war flags unfurled,
'Twas the Engineer's Corps that was first in the field,
And the Engineers first forced invader to yield.
Where are bold enough fighters who'd claim to be peers
Of the bridge-building brigade, our own Engineers.

And then back of the lines, all those others that fought,
Silent, groping to find the great help the World sought;
They released hidden force, gave command of the air
And they conquered the brute in his submarine lair;
Every gun they kept hot, while our allies they fed,
And across fearsome seas safe our armies they sped.

And so all that we have and so all that we hold,
And most all the World's story which we must leave untold,
Our contentment in peace, our protection from strife,
Our best hopes for the future of civilized life,
Our true glories, our triumphs, our wealth all that cheers—
Are the debts that we owe to the World's Engineers.

JOSEPH B. STRAUSS,
Chicago, October, 1919.

Dedicated to the
Western Society of Engineers.

CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV APRIL 5, 1920 Number 7

ADDITIONS MADE TO OFFICE SPACE

On May 1, the office force of the Western Society will move into new quarters at 1737 and 1738 Monadnock Block, adjoining the rooms now used by the Society.

It was necessary to acquire these additional rooms because of the constantly increasing volume of business transacted by the Society. Many new activities have been embarked upon since the membership campaign. To care for these activities the office force and equipment has been materially enlarged, far beyond the capacity of the present facilities.

With this removal, the library will be enlarged and extended to include that portion of the rooms now used by the clerical force, with the exception of the Secretary's office. This room will either be retained as his office or as a committee room.

The librarian will remain in her present location to care for inquiries from the members and have general charge of the reading and reference rooms.

The room on the west side of the auditorium, now used for the accounting department, will be used as a committee room. The increased number of committees, with their many activities has shown the advisability of providing a meeting place for them where they will have easy access to the library.

With this additional space available the Society feels that it will be able to more fully fill the requirements of a technical society than it has in the past.

"Perfect service" in all departments is, and will continue to be, the aim of the Western Society. The benefits of any improvement are returned directly to the membership.

BOARD OF DIRECTION

The regular meeting of the Board of Direction was held April 12.

The president was authorized to appoint a special committee of the Society on Fire Protection and Prevention to study the engineering aspects of the matter.

The following resignations were accepted:

R. W. Runge, Milwaukee, Wis.
George C. Smith, Rockford, Ill.
Henry C. Morrison, St. Louis, Mo.

The Board adjourned to an adjourned session subject to the call of the president.

EDGAR S. NETHERCUT, *Secretary*.

TESTS TO DETERMINE RIGIDITY OF RIVETED JOINTS OF STEEL STRUCTURES

Bulletin No. 104 of the Engineering Experiment Station of the University of Illinois is a 50-page report of tests made by Wilbur M. Wilson and Herbert F. Moore to determine the rigidity of rivetted joints.

It is assumed in the design of certain parts of building frames, notably in the wind bracing of office buildings, that girders are connected to columns with rigid joints. The analyses of the stresses of the frame and, consequently, the design, are based upon this assumption. If the joints are not rigid, both the stress distribution and the strength of the frame may be affected.

The questions to be answered by the tests reported in Bulletin No. 104 were:

(1) Are rivetted joints of the types usually used perfectly rigid?

(2) If the joints are not perfectly rigid, is the lack of rigidity of such nature and of such magnitude that the stress distribution is seriously affected?

(3) Does the strength of the connections, as measured, check with the computed strength?

Two duplicated specimens of each of six types were tested. These specimens were full size connections. All specimens were tested to destruction. Although two specimens of a type are not sufficient to establish final conclusions, identical specimens behave very much in the same manner. The tests indicate that the following statements are true:

(1) Two types of connections having large wing plates commonly used for wind bracing in office buildings may, for the purpose of design, be considered as perfectly rigid.

(2) Of these two types, the one having lug angles connecting the wing plate to the column is as rigid and as strong as the one in which the wing plate is inserted between the flange angles of the column. As the former of these two connections is cheaper and easier to erect than the latter, the practical value of this statement is very great.

(3) Connections without wing plates, though strong are not rigid and may cause a stress distribution materially different from rigid joints.

(4) One connection failed by buckling of the edge of the wing plate, indicating the importance of stiffening the edges of such plates.

(5) The strength of all connections, as measured, checked reasonably well with the computed strength.

Some of the results are so unexpected that further tests are highly desirable.

Copies of this bulletin may be obtained free by application for Bulletin No. 104 to the Engineering Experiment Station, University of Illinois, Urbana, Illinois.

CHARLES W. HUNT ELECTED SECRETARY EMERITUS, A. S. C. E.

Dr. Charles Warren Hunt, for twenty-five years secretary of the American Society of Civil Engineers, at his own request has been relieved from active duty and has been elected Secretary Emeritus. This office was created for him by a special resolution by the Board of Direction of the A. S. C. E. The text of the resolution follows:

"Whereas, Dr. Charles Warren Hunt, after twenty-five years of devoted and efficient service as Secretary of the American Society of Civil Engineers, during which he has contributed to its upbuilding and prosperity to a degree which places the Society under lasting obligation to him, has indicated his desire to be relieved from active duty; and

"WHEREAS, He possesses an intimate knowledge of the business of the Society and has an extensive acquaintance with its membership which renders his advice and assistance of the greatest value to the Society and its Board of Direction, the benefit of which they can ill afford to lose; therefore be it

"*Resolved,* That Dr. Charles Warrent Hunt be and hereby is appointed Secretary Emeritus of the American Society of Civil Engineers at a salary of $9,000 for the coming year and a salary of $6,000 per annum thereafter, with such duties as the Board of Direction may assign to him."

Born in New York City on May 19, 1858, Dr. Hunt graduated from New York University with the degrees of B. S. and C. E. During the next sixteen years he engaged in the practice of his profession.

In 1882, while associated with the Brooklyn Elevated Railway Co., Dr. Hunt was elected Assistant Secretary of the Society. Acceptance of this position meant financial loss to him, but in it he saw an opportunity to serve his fellow professional men.

His creed in assuming the Secretaryship of the Society was that the technical society should "advance engineering knowledge and practice and preserve the high character and professional qualifications of its membership, maintain the dignity and standing of the organization, keep in touch with and take proper action on all matters in which the relation of the profession to the public is involved, and to do whatever is possible for its members individually."

During his administration Local Sections of the Society were formed, and now there are twenty-five of these associations in various cities of the United States. Under his direction the American Society of Civil Engineers became one of the four founder Societies, and established headquarters in the Engineering Societies' Building in New York.

Dr. Hunt expressed great interest in the Library of the Society, and after two years of thoughtful and systematic effort placed the Library in the front rank. He was responsible for numerous changes in the publications of the Society during his term of office. The "Bulletin," the "Monthly Proceedings" and numerous special technical publications were published by the Society.

In 1903 he personally supervised and directed the work of organizing the International Engineering Congress of the Louisiana Purchase Exposition.

In addition to these instances of special service rendered by Dr. Hunt. are a multitude of services—services which are of greatest importance and yet cannot be stated in a way which will indicate their relation to the success of the Society. Dr. Hunt by his ability for detail and also by a native insight in the relative importance of the various demands on the Society, has been the guiding genius of the Society during these years.

Joseph E. Love, Associate W. S. E., has resigned his position with Joseph T. Ryerson and Company and is now on the editorial staff of "100%," the efficiency magazine, published by the Harold P. Gould Publishing Company.

CHAIRMAN ALLEN REVIEWS PUBLIC AFFAIRS' UNIT WORK

By Andrews Allen, M. W. S. E.—

The Public Affairs Committee of the Western Society of Engineers has been organized with a membership of forty, divided into the following sub-committees:

General Chairman...ANDREWS ALLEN
Secretary ....E. H. VARRALL

CONSTITUTIONAL CONVENTION
Chairman...............J. L. JACOBS

CITY ZONING
Chairman............PAUL E. GREEN

HIGHWAYS
Chairman.............M. L. GREELY

ENGINEERING EMPLOYMENT
Chairman............G. W. RISTINE

URBAN TRANSPORTATION
Chairman...........H. H. EASTERLY

SMOKE ABATEMENT
Chairman...........Not yet selected

It is intended that the various sub-committees will hold their own meetings, acquaint themselves thoroughly with the various problems, engineering, or otherwise, coming in their particular field and then report to the general committee with such recommendations for action as they may see fit to make. The general committee will decide what action is to be taken and will report to the Board of Direction or the Society. The membership of the Society will be kept advised of the work of the Public Affairs Committee through the pages of the Journal which will report the business done at the meetings of the Committee which are being held every Monday noon.

Our Public Affairs Committee will endeavor to co-operate with similar committees of other associations such as the Union League Club, Chicago Association of Commerce, City Club, etc., so that concerted action may be had on such matters as demand it.

The first definite action by the committee was taken last month on the question of changing the limiting height of buildings in the City of Chicago from 200 to 260 feet. Resolutions were passed and sent to the Mayor and Common Council of the City of Chicago and also to the Chairman of the Committee on Buildings, opposing this change upon the grounds that the entire question should be referred to the City Zoning Committee which is soon to be appointed and some scientific and uniform rule should be adopted instead of hampering the Zoning Committee with one more arbitrary condition.

This resolution failed of result as the change in height of buildings from 200 feet to 260 feet was passed by the Council.

Our next action was to oppose by resolutions given to the public press and to our membership, the passage of the various bonding propositions which were voted on last Tuesday. We opposed these bonds not because we opposed the objects for which the bonds were to be used but for general business reasons. The resolutions were as follows:

The bond issue, amounting to $34,500,000, submitted to the voters of Chicago on April 13, was not supported by the Western Society.

On April 5, the Public Affairs Committee made public a report condemning the issuance of more bonds on the grounds that approval of this issue would exceed the debt-incurring power of the city by about $33,000,000.

"This conclusion," said the report, "is based on the analysis of facts relative to the present municipal bond situation, the need of a comprehensive financial and well balanced public works program, the limitations due to shortage of labor and materials and possibilities of important changes which may be necessitated after work on authorized engineering improvements is started.

"The present debt-incurring power of the city of Chicago is slightly more than $82,600,000, which is 5 per cent of the assessed valuation. Bonds to the amount of approximately $45,500,000 are now outstanding and additional bonds, to the amount of about $36,000,000, have already been approved by the voters. These are unsold and little work has been begun on the projects involved. Some of these unsold bonds are for similar projects and improvements for which it is planned to use the moneys from the proposed new bonds. With the approval of the proposed bonds of $34,500,000 the debt-incurring power of the city will have been exceeded by about $33,000,000. The actual disposal of such bonds, will, of course, be made impossible until the retirement of bonds outstanding.

"On the basis of sound business and engineering policy, and in the interest of the municipality and all concerned, it is clear that the city should not further tie up its debt-incurring power at this time. There seems to be no immediate or urgent need for starting on the additional ventures, and for the issue of bonds at present low bond values, until further progress is made on improvements already authorized. As it will not be possible to amend the bond proposals after they have once been approved, it is wise policy that they be defeated at this time and sent back for more mature consideration and planning of financial and public works needs of the city.

"The committee further believes," the report concludes, "that no blanket bond issues should be adopted at this time, and that all bond issues submitted to the voters should be based on estimates and data fully justifying the object and amount of same."

These resolutions were printed in the Daily News and Chicago Tribune and undoubtedly did their part in defeating the bond issues.

We are now working on a series of resolutions to be submitted to the Constitutional Convention and the last two meetings of the Committee have been devoted to this matter. The resolutions are now in the hands of the Board of Direction for action preliminary to making them public.

We also have under consideration the controversy now nearing settlement between the Straus Bascule Bridge Company and the City of Chicago regarding infringement of their patents and a special committee of three is to make a report of the facts at an early date.

It is our aim to establish connections with the daily press so that important matters in which we take action may be brought to the attention of the public and we also hope to establish such connections as will encourage the papers to come to us for their engineering data and advice in engineering subjects.

The committee hopes that all members of the Society will feel free to suggest appropriate matters for investigation and action. All suggestions of this kind will receive prompt acknowledgment from the committee and, if the matter warrants it, will be assigned to a special or regular committee, the facts ascertained and such action taken as seems to be best.

The work we are attempting to do this year is in line with the work done and the recommendations made by the Public Affairs Committee of 1919, and is a continuation of their work, but on a larger scale than before.

The questions handled so far have been quite clearly of an engineering nature but the questions before the Constitutional Convention are not all of this kind. Neither the Board of Direction nor the Committee so far has made any hard and fast rule as to what sort of public questions are outside of our activities and so we have so far regarded ourselves as citizens as well as engineers, and have not attempted to confine our activities to questions that are purely of an engineering nature.

COMMITTEE MEMBERSHIPS

The Committee on Committees has reported to the Board of Direction that committees of the Society have been formed with the following members:

Finance Committee

F. F. Fawle, *Chairman*

A. S. Baldwin
C. W. Shepherd
Edward Haupt
Homer Niesz
Frank D. Chase

Program and Publication Committee

G. A. Haggander, *Chairman*

A. F. Riggs
William Artingstall
H. G. Clark
A. W. Dilling
C. C. Boardman
A. L. Rice
W. S. Lacher
H. Ehrlich

Sub-Committee on Publications

P. D. Van Vliet, *Chairman*

A. A. Gray
C. A. Keller
L. R. Howson
James N. Hatch
Joseph E. Love
R. B. Harper
A. J. Schafmayer

Library Committee

I. F. Stern, *Chairman*

C. R. Dart
O. F. Dalstrom
L. E. Gould
S. A. Greeley

Membership Committee

A. W. Dilling, *Chairman*

W. S. Marston
C. W. Van Horst

Amendments Committee

A. S. Baldwin, *Chairman*

H. J. Burt
C. B. Burdick
John Brunner.

Public Affairs Committee

Andrews Allen, *Chairman*

Paul Green
F. H. Cenfield
A. J. Mason
A. S. Coffin
J. W. Alvord
R. F. Schuchardt
S. O. Dunn
G. C. Nimmons
S. I. Stocking
C. C. Brooks
E. H. Heald
C. C. Hotchkiss
R. E. Schmidt
M. L. Greeley
J. P. Cowing
W. G. Evans
J. L. Jacobs
E. J. Blair
G. W. Ristene, Jr.
S. A. Rhodes
Albert P. Allen
Robert Knight
B. D. Barker
E. P. Rich
P. S. Combs
W. D. Gerber
C. B. Ball
R. E. Kelker
C. K. Mohler
E. J Noonan
G. A. Quinlan
Frank Winds
J. A. Dailey
G. W. Tillson
G. W. Carr
F. A. Sager
E. H. Verrall
H. H. Easterly

Entertainment Committee

A. B. Benedict, Chairman

George E. Waldo
Benjamin Brooks
G. W. Gennett, Jr.
Frank E. Fisher

Excursion Committee

Cass Kennicott, *Chairman*

W. O. Batchelder
G. S. Brack
S. E. Bird
E. A. Kraft

Reception Committee

J. E. Love, *Chairman*

J. H. Brown
A. N. Branum
E. A. Rumler
L. E. Dierks
W. H. Flood
M. J. Hammer
S. T. Nelson
W. S. Lacher
Max Lowenberg
Benjamin Shapiro
T. W. Ingemanson

Increase of Membership Committee

H. T. Walsh, *Chairman*

Military Committee

Murray Blanchard, *Chairman*

Col. W. G. Arn
Capt. E. A. Evers
Major D. D. Guilfoil

Young Men's Forum

Benjamin Shapiro, *Chairman*
J. A. Dailey, *Vice-Chairman*
T. W. Ingemanson, *Secretary*

A. M. Branum
Max Lowenberg
J. E. Love
R. Manley
F. G. Vent

Materials and Methods Committee

W. C. Robinson, *Chairman*

J. L. McConnell
E. N. Lake
J. B. Blake
J. R. Cravath

Noon-day Luncheon Committee

J. H. Libberton, *Chairman*

A. P. Allen
S. C. Swanson
H. C. Gardner
George H. Lukes
Tom Wyles
C. H. Norwood

Engineering Experiment Station Committee

N. M. Stineman, *Chairman*

C. E. Anderson
F. J. Postel
W. A. Durgen
G. W. Lund
R. V. Engstrom
S. H. Ingeberg
O. P. Chamberlain
F. L. Thompson
L. W. Skov
J. L. McConnell

Student Branch Committee

A. D. Bailey, *Chairman*

Prof. John C. Penn
Prof. A. W. Mosely
Prof. Theodore Doll
Prof. Grant Beebe
Prof. John F. Hayford
E. H. Verrall

Speakers Bureau Committee

J. R. Cravath, *Chairman*

A. Scheible
L. C. Spake
J. F. Hayford
K. E. Kellenberger

Terminals Rail and Water Committee

J. R. Bibbins, *Chairman*

Inland Waterways Committee

E. T. Perkins, *Chairman*

Col. W. V. Judson
G. B. Massey
Isham Randolph
Langdon Pearse
Sutton Van Pelt
C. B. Burdick

National Department of Public Works

W. L. Abbott, *Chairman*

Aviation Committee

J. F. Hayford, *Chairman*

Fred A. Preston
F. A. Sager
Walter Painter
Arthur R. Rhenisch

Development Committee

E. T. Howson, *Chairman*

A COMMUNICATION

Chicago, Illinois, April 13, 1920.

Mr. F. K. Copeland, Pres.,
Western Society of Engineers,
Chicago, Illinois.

My dear Mr. Copeland:

No doubt you have noticed in the morning papers a brief account of the Majority Report of the Congressional Investigating Committee, relating to the construction of the army camps and the alleged extravagance of the expenditures therefor, particularly with reference to the plan for constructing them under the so-called "cost plus" form of contract.

This is a matter that vitally concerns the technical profession, in view of the fact that the plan was formulated and carried out by the most experienced constructors in the country, and they were given a free hand in the formulation of the plan and its execution.

Although the findings of the Majority Report have been evident for some time, in view of the spirit of the investigation that was made, the wide publicity now given to the report makes this an opportune time for engineers to answer, in such manner as will give the widest publicity, the implied accusations, and the attempt to discredit the capability of the patriotic members of the technical profession who contributed so largely to the success of the war. From the standpoint of the politician, the report may be justifiable by the exigencies of politics, but there is apparently no other warrant for the reported findings.

Men familiar with large construction undertakings are practically a unit, in the belief that the government's war construction work could have been accomplished in no other way, than under an arrangement similar to the one pursued. But the layman, until it is pointed out to him, does not appreciate that under the emergency that existed it was impossible to prepare plans and specifications, take bids, award lump sum contracts and construct 32 cities aggregating 700,000 population, and to have them ready for occupancy within ten weeks after the selection of sites.

Everyone knows that extreme rapidity in construction involves expenditures not required when time is available for a more orderly procedure. *But when it is recalled that the war cost the United States about* $1,000,000 *per hour, and was costing* $2,000,000 *per hour near the end, the total expenditure for the army camps, amounting to less than* $200,000,000 *looks comparatively small, and the* $80,000,000 *alleged to have been wasted would apparently all have been justified if it shortened the war by forty hours.* When, further, it is recalled that our war expenditure was less than one-fifth that of our allies, and that our troops arrived in Europe not a moment too soon, the report of the Congressional Committee looks much like peanut politics.

In keeping with the policy of the Society, to seek the welfare of the engineering profession and promote the public interest, it is believed that a proper consideration of the matter would be proper for the Public Affairs Committee of the Western Society of Engineers, and that their findings should be given the widest publicity possible.

Very truly yours,

Charles B. Burdick.

JOURNAL
OF THE
WESTERN SOCIETY
OF
ENGINEERS

"To promote and advance the science and art of engineering."

BRAWN TAKES ITS PROFIT FROM BRAINS

Many thousands of passersby who have been wondering for months whether the new Michigan boulevard bridge would fit when the two leaves were lowered have been put at ease. Thousands watched as the massive steel framework descended accurately into the grooves prepared for it.

The demonstration furnishes steel and concrete evidence of the value of an industrial and economic system which fosters and rewards superior mental faculties. The construction of such a bridge is made possible by the fact that scientists and engineers have produced structural steel, and other superior minds have diversified and improved its uses.

Without such minds behind them, the laborers could have accomplished nothing. Without the accurately prepared beams and trunnions the most highly skilled structural workers would have been helpless. Without the creative ability of the engineers there would have been no bridge for Chicago and no positions at high wages for those who did the manual work.

The mind which is able to conceive and execute such a structure is developed because it is rewarded by both pay and position. It makes possible the prosperity and comfort of those who otherwise would be crossing the river on tree trunks.

The bridge is a monument to the general value of rewarding ungrudgingly those who contribute by their superior ability to the welfare of all.—*Chicago Tribune.*

The Secretary sent the following communication in appreciation of the editorial:

Editor, Chicago Tribune,
Chicago, Ill.

Dear Sir:

Engineers will be very much interested and appreciate the editorial in the Tribune of April 5th under the title of "Brawn takes its profit from Brains." I take this occasion of expressing my personal appreciation of this editorial.

As is suggested the Michigan Boulevard Bridge is a splendid example of successful planning, involving measurements, calculations, construction and supervision such as engineers are required to do in all similar projects. The care and accuracy of such work is a service which we are rendering to the public far beyond the compensation received, and insures the health, safety and convenience of the people.

Yours very truly,
(Signed) Edgar S. Nethercut,
Secretary.

BRIDGE AND STRUCTURAL SECTION

The regular meeting of the Bridge and Structural Section occurred April 12, with Hugh E. Young, Engineer of Bridge Design, City of Chicago, as the principal speaker of the evening.

Mr. Young spoke on the special features of the Michigan Avenue and other improvements with particular reference to the "Boulevard Link Bridge."

He prefixed his talk with a resume of the difficulties experienced in making preparations for the many city improvements. Mr. Young illustrated his paper with slides showing the main features of construction and design in the improvement along Michigan Avenue. There was a lengthy discussion.

One hundred eighty-five members were present, J. E. Love, vice chairman of the section, presiding.

WATER POWER DEVELOPMENT IN CANADA

The Dominion Water Power Branch, Department of the Interior, and the Dominion Bureau of Statistics, Department of Trade and Commerce, have through co-operation, just completed an exhaustive census and analysis of the developed water power in Canada. The figures, which are complete to January 1, 1920, are exceptionally interesting and are indicative of the marked manner in which the water power resources of the Dominion are being put to advantageous use. Practically every great industrial center in Canada is now served with hydro-electrical energy and has within easy transmission distance ample reserves of water power. Active construction in hydro-electrical enterprise is fast linking up the few centres which are still unserved, and which have water power resources in their vicinity. In those localities where water power is not available, nature has bountifully supplied fuel reserves of coal, gas or oil.

According to a recent computation the water power resources of Canada are placed at 20 million horse power. This figure represents the power available at sites at which more or less definite information is to hand.

According to the statistics just compiled there is installed throughout the Dominion some 2,418,000 turbine or water wheel horse power of which 2,215,000 horse power is actually and regularly employed in useful work. The larger figure includes the total installed capacity at full gate, including reserve units. It does not, however, include hydraulic exciter units. A large number of the plants now operating are designed for the addition of further units as the market demands. The ultimate capacity of such plants, together with that of new plants now under construction, totals 3,385,000 horse power.

Of the total power installed, 1,756,791 h. p. or 72.7 per cent is installed in central electric stations, engaged in the development of electrical energy for sale and distribution. Central station power is sold for lighting, mining, electro-chemical and electro-metallurgical industry, milling and general manufacturing. In the pulp and paper industry 473,265 h. p. is utilized of which 381,631 h. p. is generated directly from water in pulp and paper establishments while 91,634 h. p. is purchased from hydro central electric stations.

Hydro power used for other purposes and other industries may be listed as follows: For lighting purposes, 434,613 h. p.; in mining industry, 177,728 h. p.; in flour and grist mills, 42,736 h. p.; in lumber and saw mills, 37,918 h. p; in other manufacturing industries, 172,955 h. p. These figures are evidence of the widespread manner in which the Dominion's water power resources are being applied to the furtherance of its industrial development.

The total installation of 2,417,896 h. p. is comprised of 3,370 units of an average capacity of 715 h. p. While 2,244 of these units are of 100 h. p. or under, they contribute only 82,204 h. p. or 3.4 per cent to the total. A total of 1,845,427, or 76.3% of the whole is contributed by units of 2000 h. p. and over; 1,391,025 h. p. or 57.6% by units of 5,000 h. p. and over; 1,029,900 h. p. or 42.6% by units of 10,000 h. p. and over; and 160,000 h. p. or 6.6% by units of 20,000 h. p. and over. This is illustrative of the modern tendency towards the installation of large units. Reference might be made in this connection to the 50,000 h. p. turbines which are contemplated for the new development of the Hydro-Electric Power Commission at Queenston.

The central station industry has made great strides in Canada in recent years. A network of transmission systems, which are being rapidly extended from year to year, covers central and southwestern Ontario and southern Quebec. Other systems established in numerous centers from coast to coast are likewise rapidly extending their scope. Ninety-one point four per cent of the primary power used in the central stations throughout the Dominion is derived from water, evidencing in a striking manner the advantageous location of the water power resources to industrial centers.

The total installed water wheel and turbine horse power in hydro central electric stations is 1,756,791 h. p. Fuel auxiliaries installed as standbys to these hydro stations brings the total installed primary capacity up to 1,873,989 h. p. connected to 1,449,180 k. v. a. dynamo capacity. The total capital invested in these central stations, inclusive of transmission and distribution systems, is $369,464,961 or an average of $210 per installed primary horse power.

Of special interest to engineers is the actual cost of construction of hydro-electric power stations, exclusive of transmission and distribution systems. The figures of 70 representative hydro-electric stations throughout the Dominion with an aggregate turbine installation of 745,797 horse power show a total construction cost of $50,740,468 (pre-war figures) or an average of $69.11 per installed horse power. This cost includes the capital invested in construction of dams, flumes, penstocks, and all hydraulic works, and of power stations and equipment. It excludes real estate and transmission and distribution equipment. The figure in brief represents the capital cost of construction at the power site.

With a water power development of 274 h. p. per thousand population, Canada stands well in the forefront in respect to availability and utilization of hydro power resources, being only surpassed in this respect by Norway. The enormous water power reserves still untouched form a substantial basis for the progressive exploitation and development of other natural resources, and, if properly co-ordinated with the development and utilization of the enormous fuel resources of the Dominion, are an assurance of continued industrial expansion and prosperity.

NEW MEMBERS

The following were elected to the grade of membership indicated on March 25:

8 Anderson, Eugene A, 2031 Harrison St., Evanston, Ill. Assoc.
13 Zimmerling, Raymond O., 2635 Emmet St. Assoc.
38 Nechin, Abraham, 1314 So. Troy St. Junior. (Transfer from Student.)
41 Sullivan, John H., 2414 No. Kimball Ave. Member.
58 Smith, Edward J., 53 W. Jackson Blvd. Member. (Transfer from Assoc.)
303 Burnham, William A., 1341 Edison Bldg. Assoc.

645 Spake, L. C., 1570 Old Colony Bldg. Assoc.
760 Davis, Uriah, 72 W. Adams St., Rm. 529. Member.
1089 Rossen, Henry, 1716 N. Kedvale Ave. Junior.
1376 Franklin, Jack, 231 Insurance Exchange. Associate.
1435 Wiessner, L. T., 192 Cochran St., Blue Island, Ill. Junior.
1437 Vernon, Alfred, Harvester Bldg. Affiliate.
1530 Thompson, Morris, 58 Beacham St., Everett, Mass. Member.
1549 Farber, E., General Electric Co., Monadnock Block. Member.
1560 Mennie, Robert S., 935 LaSalle St. Sta. Member.
1604 Morash, Jas. B., General Electric Co., Monadnock Block. Member.
1627 Culver, J. R., 3819 Janssen Ave. Member.
1636 Simpson, Dalbert, 902 Railway Exchange. Member.
1637 Klatte, A. J., 1020-105 So. LaSalle St. Member.
1648 Anderson, Arthur G., Bureau of Engineering, City Hall. Member.
1651 Jamieson, William J., 1744 Monadnock Block. Member.
1652 Karkow, Andrew S., 5152 Hutchinson St. Member.
1653 Lahey, Charles W., 6743 Blackstone Ave. Associate.
1657 Smith, Morton E., 7616 Murphy St. Associate.
1705 Rudd, W. G., 31st St. & Pitney Court. Member.
1735 Kearns, J. E., Monadnock Block. Member.
1825 Robinson, Wallace A., 6005 Prairie Ave. Member.
1842 Moores, Charles H., 746 First Nat'l Bank Bldg. Member.
1843 Church, Arthur L., 1041 E. 47th St. Member.
1872 Picerno, Robert, 416 N. Racine Ave. Junior.
1931 Stephenson, John W., 1337, 72 W. Adams St. Member.
1939 Howe, Woodbury, 3015 E. Douglas Ave, Wichita, Kan. Member.
1943 Megrew, Geo. W., 1000 Railway Exchange Bldg. Member.
1950 Bradbury, Clifford C., 1315 Monadnock Block. Member.
1983 Baird, Clyde H., 11340 Parnell Ave. Assoc.
1991 Teuber, Charles F., 1229 S. State St. Associate.
2001 Scotford, Louis C., 6433 Harvard Ave. Student.
2002 Oleksy, Joseph J., 2252 N. Lorel Ave. Student.
2003 Hammerman, Meyer A., 908 So. Ashland Blvd. Student.
2004 Matson, Eugene M., 946 Edgecomb Place. Student.
2005 Mundt, Edward, 3232 So. Michigan Ave. Student.
2007 Jones, W. S., 1203 Hartford Bldg. Member.
2015 Johnson, Harley A., 116 So. Hamlin Ave. Member.
2040 Lilienthal, Samuel, 3340 Douglas Blvd. Junior.
2046 Phillips, Bernard, 10638 Langley Ave. Assoc.
2052 Zielas, John, 4814 N. Sawyer Ave. Member.
2060 Spaulding, Roy S., 9925 Prospect Ave. Member.
2 Breskin, Chas. A., 1628 S Sawyer Ave. Student.
6 Regester, C. W., 111 W. Washington St. Member.
9 Peterson, Walter E., 4723 Fulton St Student.
12 DelCampe, Scipione, 2121 W. Taylor St Assoc.
35 Morden, Wm. J., c|o Morden Frog & Crossing Works, 208 S. LaSalle St. Member.
39 Earle, Ernest A., 4646 Prairie Ave. Assoc.
42 Missbach, A. M., 5108 Gran St. Assoc.
44 Meyer, Edward, 2653 N. Ashland Ave. Assoc.
205 Scharmer, Otto, 1913-139 N. Clark St. Assoc.
206 Salzman, A. P., 30 N. LaSalle St. Member
208 Loeb, Hugo D., 816-30 N. LaSalle St. Affiliate.
209 Conaty, John P., 4944 Michigan Ave. Junior.
279 Oesterreich, E. W., Rm. 500, 72 W. Adams St. Assoc.
325 Read, Chas. F., Rm. 1828, 175 W. Jackson. Assoc.
326 O'Toole, P. W., 140 S. Dearborn St. Affiliate.
402 Wade, J. Wm., 1027 Marquette Bldg. Member.
424 Primrose, C. Lee, 186 N. LaSalle St. Member.

451 Friedman, R. N., 1900 Steger Bldg. Member.
456 McArthur, Wm., 5622 Grover St. Assoc.
470 Martin, T. G., c|o Automatic Electric Co., 1001 W. Van Buren St. Member.
588 Knehans, Wm. H., 431 S. Dearborn St. Member.
654 Walton, Chas. L., 5231 Cornell Ave. Member.
880 Levine, Louis, 332 S. Michigan Ave. Member.
984 Day, D. R., 1329 Peoples Gas Bldg. Affiliate.
1063 Mansfield, G. S., 11127 Watt Ave. Member.
1144 Lafferty J. Sam., 3400 Sunnyside Ave. Assoc.
1225 Casey, Maurice, 1566 Conway Bldg. Member.
1244 Gage, R. H., 3141 S. Hoyne Ave. Member.
1359 Peterson, Arvid R., 111 S. Jefferson St. Assoc.
1432 Thoren, J. N., 7923 Princeton Ave. Member.
1467 Cooper, Frank H., 105 S. LaSalle St. Member.
1472 Murray, D. J., 5633 S. Sangamon St. Member.
1474 Burnet, W. A., Swift & Co. Construction Dept. Member.
1478 Bolton, Earl H., 5600 Calumet Ave. Assoc.
1484 Sexton, Frank A., 5114 Glenwood Ave. Assoc.
1489 Haigh, Arthur H., 140 S. Dearborn St. Member.
1524 Weinacht, Wm. N., 4848 Evans Ave. Associate.
1543 Condon, E. J., 704 Harris Trust Bldg. Member.
1613 Boisen, L. N., 1117 Monadnock Bldg., L. E. Meyers Co., Member.
1635 Rodkin, A., 6911 Edison Park Ave. Assoc.
1642 Fox, Morris J., 203 S. Dearborn St. Member.
1644 Smith, A. H., 1001-203 S. Dearborn St. Affiliate.
1659 Walker,. Stanton, 3402 Franklin Blvd. Assoc.
1664 Fainstein, Morris, 2142 Iowa St. Student.
1674 Hanley, T. F., c|o Hanley & Co., 3438-3444 Forest Ave. Member.
1677 Seifried, John Francis, 5467 Augusta St. Assoc.
1707 Friese, Herman R., 1226 Highland Ave., Oak Park, Ill. Member.
1713 McCormick, F. H., 5660 W. Taylor St., Oak Park, Ill. Assoc.
1714 Burritt, Albin, 5449 Flournoy St. Member.
1717 Marriott, Wm. A., c|o C. Wieboldt Construction Co., 1534 W. Van Buren St. Member.
1729 Harkness, W. E., 64 W. 15th St., Chicago Heights, Ill. Member.
1747 Dickinson, Herbert S., 15240 Loomis Ave., Harvey, Ill. Member.
1761 Hoy, Ivan A., 6643 University Ave. Member.
1813 Immeus, Fred J., Room 700 Edison Bldg. Affiliate.
1822 Harlow, C. B., 806 W. Washington Blvd. Member.
1834 White, G. Herbert, 265 William St., River Forest, Ill. Member.
1847 Markley, Jos. C., 1615 Harris Trust Bldg. Member.
1854 Rodgers, Chas. L., Box 248, Lake Bluff, Ill. Member.
1863. Herried, Edwin S., 1515 W. Monroe St. Assoc.
1876 Chubb, J. E., 343 S. Dearborn St. Member.
1877 Pond, Frank H., 343 S. Dearborn St. Member.
1878 Rich, Edward P., 1409 Manhattan Bldg. Member.
1880 Kittle, E. B., 516 Fisher Bldg. Member.
1903 Chapin, Wm. A., 3140 Diversey Ave. Assoc.
1911 Emerson, C. M., 4500 Sheridan Road. Member.
1915 Latimer, James B., 547 W. Jackson Blvd. Member.
1917 Arenberg, Albert L., 316 S. Wells St. Assoc.
1918 Fisher, R. B., 15423 Vine St., Harvey, Ill. Member.
1922 Anderson, G. M., 911 Wellington Ave. Member.
1923 Neebe, Fred C., 2522 Aubert Ave. Assoc.
1928 Berner, Harry M., 1915 Oakdale Ave. Assoc.
1929 Roberts, H. W., 1337 Edison Bldg. Member.
1932 Peterson. H. D., 1337 Edison Bldg. Member.

1936 Bradley, Fred N., 6108 Stony Island Ave. Member.
1941 Dickinson, Harry H., 105 S. LaSalle St. Member.
1969 Kehnroth, Chas. H., 315 W. Washington St. Member.
1970 Willcox, F. H., 645 Peoples Gas Bldg. Member.
1971 McComb, Richard J., 1201 Peoples Gas Bldg. Member.
1973 Quetsch, Leonard J., 715 N. Morgan St. Assoc.
1975 Webster, Fred L., 2029 Peoples Gas Bldg. Member.
1977 Boldebuck, A. W., 20 S. Hoyne Ave. Affiliate.
1978 Boettiger, W. O., 530 W. Marquette Rd. Assoc.
1981 Tunnicliff, N. H., 801 Putnam Bldg., Davenport, Iowa. Member.
1999 Shnable, B., Box 41, Park Ridge, Ill. Assoc.
1986 Irick, Frank A., 3811 W. Congress St. Member.
2006 Williams, G. R., 212 E. Elm Ave., LaGrange, Ill. Member.
2009 Dunn, Oswald T., Amboy, Ill. Member.
2010 Burke, Harry J., 2001 City Hall Sq. Bldg. Assoc.
2011 Greenhill, Harold, 1951 Seminary Ave. Assoc.
2014 Moore, C. A., 808-30 N. Michigan Ave. Member.
2017 Thorson, Lars Martin, 1543 N. Wells St. Associate.
2022 Small, Jr., Edward A., Highland Park, Ill. Member.
2023 Ristene, Jr., Geo. W., 1246 Marquette Bldg. Member.
2027 Katzenburg, Herman S., 514 Lake St., Oak Park, Ill. Assoc.
2029 Stromback, Ernest J., 2418 N. Sawyer Ave. Member.
2033 Dans, A. H., 5317 W. Van Buren St. Assoc.
2036 Griest, E. E., 1928 W. 46th St. Member.
2043 Jones, Edward A., 6242 Blackstone Ave. Assoc.
2047 Herbert, H. G., 1743 Otto St. Assoc.
2048 Bredlan, Albert E., 2301 S. Kolin Ave. Assoc.
2050 Rohde, F. E., 2001 City Hall Sq. Bldg. Assoc.
2053 Grodsky, Morris, 2657 Division St. Assoc.
2055 Lucas, Hugh L., 525 E. 112th St. Assoc.
2056 Weldon, Wm. B., 145 S. Mason Ave. Member.
2057 Edelstein, Erwin, 1320 N. Claremont Ave. Assoc.
2058 Wolfe, Thomas F., 7248 S. Park Ave. Assoc.
2059 Eddy, Justus B., 381 E. 22nd St. Member.
2061 Bush, Joseph M., 1329 W. 73rd Place. Member.

The following were elected to the grade of membership indicated, April 12:

16 Funk, Ethel L., Miss, 619 Clinton Ave, Oak Park, Ill. Student.
18 Pearson, Corine, Miss, Des Plaines, Ill. Student.
20 Drebnyk, Charles Edward, 1934 Washington Blvd. Student.
21 Kayser, Wm. Oscar, 2222 Warren Ave. Student.
22 Powell, Byron S., Melrose Park, Ill. Student.
23 Van Dyke, Charles Henry, 3233 Winfield Ave. Student.
24 Weber, Norman Lester, 4108 N. LeClaire Ave. Student.
26 Tunius, Albert G., Lake Forest, Ill. Student.
27 Johnson, Wm. P., 519 Ford St., Geneva, Ill. Student.
29 Keiler, Marjorie A., Miss, Box 1086, Melrose Park, Ill. Student.
30 Drews, Wm. F., 2444 N. Kedzie Ave. Student.
31 Frederick, Fred G., 1111 N. Sacramento Ave. Student.
33 Shutz, Norman J., Geneva, Ill. Student.
34 Holmquest, Harry J., 407 S. Harvey Ave., Oak Park, Ill. Student.
36 Chase, Denwood S., 3251 Michigan Ave. Student.
52 Strickler, James W., 639 N. Drake Ave. Jr.
53 McSheehy, Thomas H., care American Steel & Wire Co. Assoc.
54 Ferguson, Charles R., 1949 S. Trumbull Ave. Student.
55 Hayford, Walter S., 574 Ingleside Park, Evanston, Ill. Student.
56 Menke, Edward W., 145 W. 112th Place. Assoc.

59 Bonness, Joseph Denny, 167 26th St., Milwaukee, Wis. Student.
61 Von Meding, Wm. A., 4226 Greenview Ave. Jr.
63 Newlander, Manuel M., 122 Pratt Bldg., Kalamazoo, Mich. Assoc.
64 Gibbons, John J., 181 15th St., Milwaukee, Wis. Student.
65 Hartman, Gilbert L., 181 15th St., Milwaukee, Wis. Student.
66 Lamb, Eugene, 120 Tenth St., Milwaukee, Wis. Student.
67 Lambeck, Walter M., 45 35th St., Milwaukee, Wis. Student.
68 Marx, Leo G., 619 25th St., Milwaukee, Wis. Student.
69 Pilon, Luke A., 498 A Cramer St., Milwaukee, Wis. Student.
70 Frederick, A. E., 388 12th St., Milwaukee, Wis. Student.
71 DeHaye, Joseph F., 181 15th St., Milwaukee, Wis. Student.
72 Freund, Clement J., 1421 Wells St., Milwaukee, Wis. Student.
73 Cherfetz, Solomon, 638 Ninth St., Milwaukee, Wis. Student.
813 Dode, John H., 1722 N. LaSalle St. Member.
928 Knuerr, Peter, 648 Oakdale Ave. Assoc.
1290 Evans, Floyd E., 5252 Calumet Ave. Jr.
1441 Anderson, Frank D., 2104 Montrose Ave. Assoc.
1526 Cahn, David H., 1906 Sunnyside Ave. Jr.
1534 Johnson, Victor E., 530 W. 60th Place. Assoc.
1593 Cameron, W. D., 1323 Farwell Ave. Member.
1605 Northshield, L. E., care General Electric Co., Monadnock Block. Member.
1625 Neumann, George O., 3127 Clybourn Ave. Assoc.
1846 Petroskey, V. R., 10506 Indiana Ave. Jr.
1919 Greenway, Bert, 933 E. Marquette Rd. Member.
1963 Rossrucker, E. A., Room 1000, 212 W. Washington St. Jr.
2034 Dawes, Henry M., 1615 Harris Trust Bldg. Affl.
28 Hill, Edgar Rice, Flembeau Lodge, Algonquin, Ill. Assoc.
36 Chase, Derwood S., 3251 Michigan Ave. Student.
46 Budd, C. A., 5503 Hyde Park Blvd. Member. Reinstatement.
48 Leavenworth, Own Trabue, 139 N. Scoville Ave., Oak Park, Ill. Member.
50 Sherer, Herbert H. Member.
51 Rudd, W. G., 31st and Pitney Ct. Member. Transfer from Assoc.
57 Howell, Francis N., 1737 Park Road, N. W., Washington, D. C. Jr. Transfer from Student.
60 Von Perbant, Louis K., 3434 W. 62nd Place. Member.
62 Evans, Howard W., 113 W. Washington St. Member.
193 Daniels, C. M., 1917 Peoples Gas Bldg. Member.
333 Murphy, Daniel A., 512 W. 27th St. Affl.
349 Hermansen, Einar, 3013 Allen Ave. Student. Rejected.
414 Sweet, Frank Z., 608 S. Dearborn St. Member.
658 Porter, J. C., 205 Illinois Central Sta. Member.
714 Peterson, A. H., 539 Insurance Exchange Bldg. Member.
823 Ryan, Frank R., 740 Monadnock Block. Assoc.
856 Blackmarr, Frank Hamlin, 5555 Hyde Park Blvd. Member.
873 Holbrook, Robert A., 1810 Fisher Bldg. Member.
974 Lummis, H. C., 756 Bittersweet Place. Member.
1007 Fuller, Orville N., 6620 S. Wood St. Member.
1099 Drinkwater, Fred J., 3752 Sheffield Ave. Assoc.
1123 Longstreet, Wm. H., 122 S. Michigan Ave. Affl.
1192 Wilcox, Edgar S., Amer. Tel. & Tel. Co., 212 W. Washington St. Member.
1195 Dodd, Robert C., Western Electric Co., Inc., Hawthorne Sta., Chicago, Ill. Member.
1229 Giles, D. C., 1527 E. 60th St. Member.
1245 Norlin, Fred C., 2744 Mildred Ave. Assoc.
1260 Ryan, Lawrence, Room 506, 549 W. Washington St. Assoc.
1264 Mals, Herman W., 4822 Hutchinson St. Member.

EMPLOYMENT SERVICE

NO CHARGE is made for opportunities announced in this section of the Journal.

ANNOUNCEMENTS must not be more than sixty-five words in length and will not be inserted more than twice during a period of two months, during which time all records will remain in the active files. All correspondence will be treated confidentially.

APPLICANTS for situations, not members of the W. S. E., must have card of introduction from a member of the Society.

ALL REPLIES should be addressed to the key number indicated, in care of Employment Bureau, Western Society of Engineers, 1735 *Monadnock Block, Chicago.*

SITUATIONS WANTED

B-450: BUILDING STRUCTURAL Engineer, Illinois State license. Civil graduate. 30; family; American. 4 years' clerical work; 7 years' engineering, concrete, steel and timber design; industrial buildings; warehouses; railway engine terminal layouts and buildings. Last 1¾ years in charge of squad. Some experience in bridge work. Salary $3,600 in engineering or allied work. Arrange interview.

B-451: ELECTRICAL ENGINEER with large manufacturer of electrical freight and passenger elevators desires a position as sales engineer. Have had excellent engineering education and broad practical experience with railway signals, remote electric control, industrial application of A. C. and D. C. motors and controllers and expert knowledge of electric elevator problems. Age 31. Excellent references.

B-452: YOUNG MAN, 23, WANTS work on construction projects, surveying, bridges, etc., out of town if possible. Have no experience. Attending school next term.

B-453: GRADUATE C. E. 11 years' experience heavy masonry and steel construction, railways, power plants. One year chief engineer oil company in Mexico. Want Chicago connection as sales or resident engineer, superintendent or estimator. Min. salary, $300.

B-454: GRADUATE C. E. AGE 28. Single. 2½ years' experience in bridge dept. of western railroad and at present employed by bridge company; will consider offer where his experience will be of value.

B-455: POSITION WANTED IN Middle West, preferably with some architect or building surveyor of repute, as sanitary engineer competent to supervise building erection from start to finish and also to take charge of drafting room. American, 40, have had foreign experience in sanitation; references. Former Assoc. Member A. S. C. E.

B-456: GRADUATE C. E. WITHout building construction experience, wants opportunity to start in outside building work. 6 months' experience with cost keeping systems; 3 months on heavy construction.

B-457: YOUNG GRAD. MECH. eng.; agreeable personality, initiative and sales ability is seeking sales engineering position or one leading thereto. Four years experience designer, engineer, sales engineer in heat treating equipment and power plant work. Present sales engineer truck axles.

B-458. GRAD. MECH. ENGR., 10 years experience machine design,

detail and construction work; would consider change. Age 34, married, best references.

B-459: YALE SHEFFIELD GRADuate B. S. degree in C. E., at present employed, will be open for propositions about June 1. Experience asst. surveyor; Alaskan Boundary, engineer; Chicago Tunnel, instrument man, chief of party; designer, estimator, and engineer various construction projects. Best references. What have you to offer?

B-460: C. E. EXPERIENCED IN concrete and steel and railroad terminal construction, valuation work. Now in charge of inventory and appraisal for government department, desires position in Chicago. Some experience in raw material, purchase and production work.

B-461: MECH. AND SALES ENgineer wants sales agency for steel or malleable iron in mechanical line. Experienced as sales engr., designer, inspector, shop supt. and office manager. Knows R. R. and general manufacturing trade. Has pleasing personality, good executive and not afraid of hard work.

SITUATIONS AVAILABLE.

A-50: DRAFTSMEN AND DEsigners wanted; preferably single man. Salary $250. Location, Ontario, Canada.

A-51: PRACTICAL COMMON sense builder, able to take off quantities and price same. Engineer and estimator preferred.

A-52: SALESMAN ESTIMATOR for general machine shop work, with large construction company in Pennsylvania.

A-53: WANTED—STRUCTURAL detailers and checkers experienced on structures for coal or ore handling machinery. Communicate directly with Allen and Garcia Co., 955 McCormick Bldg., Chicago.

A-54: TWO VACANCIES IN structural valuation work. Must be able to compute and price birdges, trestles and culverts based on plans and field notes. Work in Chicago office. Salary $160 and $170. Prospects for increases.

A-55: WANTED—ONE CONveyor man, not necessarily designer; one foundry draftsman; one young man with architectural experience. Must be able to make plat plants.

NEW APPLICATIONS

The following applications for membership were presented to the Board of Direction March 25:

57 Howell, Francis M., Washington, D. C. Transfer from Junior.
58 Smith. Edward J., Chicago, Ill. Transfer from Associate.
59 Bonness, Joseph Denny, Milwaukee, Wis.
60 Von Perbandt, Louis K., Chicago, Ill.
61 Von Meding, William A., Chicago, Ill.
62 Evans, Howard W., Chicago, Ill.
63 Newlander, Manuel M., Kalamazoo, Mich.
64 Gibbons, John J., Milwaukee, Wis.
65 Hartman, Gilbert L., Milwaukee, Wis.
66 Lamb, Eugene J., Milwaukee, Wis.
67 Lambeck, Walter N., Milwaukee, Wis.
68 Marx, Leo G., Milwaukee. Wis.
69 Pilon, Luke A., Milwaukee, Wis.
70 Frederick, A. E., Milwaukee, Wis.
71 De Haye, Joseph F., Milwaukee, Wis.
72 Freund, Clement J., Milwaukee, Wis.
73 Cherfetz, Solomon, Milwaukee, Wis.

D. J. Brumley, M. W. S. E., has been named chief engineer of the Chicago Terminal Improvement of the Illinois Central R. R., with offices in Chicago, A. S. Baldwin, vice-president, recently announced.

TECHNICAL SECTION

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Factory Fire Protection

By BENJAMIN RICHARDS,
Chief Engineer, Western Factory Fire Insurance Association.

Presented February 16, 1920.

I WILL try to outline, in this informal paper, the why and the how of Factory Fire Protection.

Protection against loss by fire may be roughly divided into three main branches. The first is indemnity against loss, which, in its most common form, is ordinary fire insurance. The second means of protection against loss by fire is the providing of apparatus for extinguishing fires readily, with the object of keeping the fire loss at a minimum. The third is fire prevention, the object of which is to prevent fires from starting. Full fire protection necessitates the use of all three of these methods. The very best preventive measures which may be devised are bound to fail at times, as they are limited by their necessary dependence upon human frailty. The second, fire protection, is more or less successful, but even with all the modern and extensive means for extinguishing fires now used, modern fire protection is not adequate to prevent a fire loss in this country of approximately three hundred and fifty million dollars a year. The first mentioned branch, fire insurance, in our present social structure, is essential and will so continue to be until the distant day arrives when economics and morals will no longer countenance a public bent on destroying by fire a goodly part of its own annual accomplishments and will relegate the fire demon and all his works to the unsteady but sure exit, so lately and gracefully accomplished by his late brother in crime, John Barleycorn. Fire protection should be of especial interest to those in charge of large industrial plants because of the severe fire hazards and large values involved, and the necessity for protecting accomplishments, often representing years of skillful effort and development of many minds.

There are four vital features essential to the success of a modern, large industrial plant, each of which demands full fire protection, and if that plant is to be considered as a properly safeguarded and well conducted industrial establishment.

First: Fire protection is necessary to protect capital, the stockholders and others financing the industry.

Second: Fire protection is necessary to establish security for credits in order that working capital and necessary loans may be negotiated and safeguarded.

Third: Full fire protection is essential to insure continuity of output and stability of the business. Some industries have been total failures because a bad fire interrupted the business, and before recovery trade had gone to their competitors.

Fourth: Some form of fire protection is desirable, but not necessary, to assure the continuance of established profits, for often profits stop with production and production stops with a bad fire.

From the time material is on the grounds for the erection of a new industrial plant, guarding against loss by fire begins, either through action of the owner or the interested contractor. This first security is usually obtained by purchasing fire insurance covering the materials on the ground and construction under way, such insurance in the vernacular of the business being called a "builder's risk." Often further protection is obtained for builder's risks by their being located where the protection of public fire departments and hydrants is available. Often some special protection may be obtained. Contractors are deplorably weak in fire prevention and protection, the annual losses on buildings under construction being very heavy. A reinforced concrete building under construction is especially subject to fire loss on account of the large amount of lumber necessary to its erection and, if the building is built in winter, the necessity of maintaining salamanders, the use of hay and other means to prevent freezing of the concrete before it is set, present a very marked fire hazard.

As the contractors turn over the property to the owners, the latter must insure it to protect their capital; first, the buildings, second the machinery, and then the stock as it is added. With manufacturing fully under way, inherent hazards due to the necessary processes are immediately involved and if stability to the business and continuity are fully considered, fire protection and prevention appear as vitals and must be skillfully applied according to the conditions. Without such protection, almost any manufacturing plant has, within itself, means for self-destruction or at least means whereby fire may interfere seriously, if not totally, with its output and therefore with its profits. Interruptions by fire mean shipments interfered with, promises broken, customers annoyed and often lost to others, and the entire smoothly running plant put into disorder and confusion, all these being in addition to the physical loss on property actually destroyed or damaged by fire and water.

Fire insurance is usually purchaseable to protect any desired percentage of the values of a plant. Fire insurance presumes to replace physical values lost by fire and does not protect against the loss from depreciation, interruption and other such abstract losses, except that a special form of fire insurance can be purchased to cover losses from interruption of output and profits. The most that ordinary fire insurance can do is to more or less re-establish the physical plant which has been damaged. It is a fixed principle of insurance that all owners shall share a portion of their loss in order that self-interest may act as a fire prevention means by tending to care in guarding against fire. In special cases an owner may take a large risk himself, if he so desire, protecting only by insurance the necessary requirements of the banks or other financial interests that may be interested in security for loans made to the concern. If large industries should carry an insurance fund of their own, it would practically involve their going into the insurance business for themselves, which calls for expensive and elaborate fire protection service departments. This service is ordinarily assumed by the large insurance companies and is freely rendered to all purchasing their policies. Years of expert specialization has made this service of great value. Continuity of output values and profits may be covered by so called "Use and Occupancy" insurance, profit insurance or rent insurance as may be applicable to the particular conditions.

There is absolutely no insurance purchaseable which can guarantee continuity of output and cover all losses due to its discontinuance. These can only be safeguarded by fire protection and fire prevention. This fact often is not appreciated by the average modern plant production engineer. Let him ever bear in mind that for full fire protection to a well established industry, there must be carried an ample amount of insurance, full modern fire protection well maintained and continual voluntary fire prevention measures executed with vigilance. And all these, at their best, involve full coöperation with the insurance companies which spend thousands of dollars yearly to study fire losses, compile statistics, maintain laboratories and extensive engineering organizations and who may be presumed to have available the best data on the subject.

Insurance is a commodity purchaseable from various sources at various prices, its cost being in proportion to the risk involved. Each insurer practically establishes his own cost of insurance. The total cost of fire protection involves the three items, insurance, protection and prevention. The less spent on protection and prevention, the higher is the cost of insurance; the lower the cost of insurance, the higher is the cost of protection and prevention. The highest priced insurance, unlike most other things, is the poorest, as it covers far from full replacement liability and carries with it no obligations toward safeguarding either the plant, its product, or its profits. As the quality and value of fire insurance increases more and more of the fire protection cost is diverted to means for protection and prevention, and less and less to the cost of the actual policy; in other words, the lowest rates purchase the best insurance and give the best protection. To repeat in another form: The most unsatisfactory fire insurance has the highest cost of policy and low or no other expense. The most valuable insurance has a low cost of policy and a high expense is involved for construction of plant, installation and maintenance of fire apparatus and cost of guarding and upkeep.

It is extremely hard for some manufacturers to get a true perspective of the real value of fire protection and prevention in its broad sense, as it relates to their particular industry. What shall it profit a man if, through the labor and the pains of years, he gains 100 per cent in efficiency of production and tomorrow loses it all, because his scheme of things ignored some simple laws of nature regarding fire? The modern production manager is truly valuable who so understands his work as to have the courage to sacrifice slightly his present daily output in order to be sure that the laws of fire will permit him to continue production on the following days. There is a tendency to so specialize in this production craze or to be so familiar and hardened to the conditions of a plant that one on the ground can easily fall into the attitude of assuming a knowledge of fire protection superior to that of specialists who have devoted years of study to the subject.

. . . I think one of the most common things we get up against is to have someone tell us that such a thing as a fire cannot occur in their plant, although we may have just come from ruins resulting from the same conditions. It is one of the great pleasures of our business that we can always find people that know more about it than we do ourselves. There is little theory in our business. If a mill is burned down from such and such a cause or condition, we simply tell the next man about it so he won't lose his mill in the same manner.

There really is something more to strive for in industry than production. Beautiful buildings and grounds are not essential to production, although wisely they are built in many instances. It would be very efficient to prepare the breakfast eggs and coffee in one's chamber, or eat in the kitchen at a "progressive assembly" dinner conveyor, but would that be a legitimate excuse for eliminating dining-rooms with all their enjoyable associations? It is obviously inefficient to usher guests from the parlor into the dining-room for dinner and serve the courses by hand from a distant kitchen, but would an odoriferous, brass railed cafeteria along the side of our living room tend to make a home or even an efficient home?

When values are low, when margins are large, when profits are easily made out of the happy charity of a fortunate country or when profits proceed from anything except real, broad efficiency, fire protection can naturally be somewhat ignored without great suffering. As margins become close, however, and competition gets keen, fires become serious affairs and real recovery from a disastrous fire is subject to doubt. We are apt at times to sympathize with him who has a fire instead of looking at him as a responsible gentleman having the audacity to place the cost of his carelessness on society.

Let us remember that a fire is a burden on us all and that fire insurance companies are simply great social institutions providing the means whereby the one man's loss is distributed and diffused among the many for the general good. The cost of extinguishing nearly all fires is likewise distributed amongst us all.

A great many manufacturers purchase fire protection apparatus for the sole purpose of getting their insurance at a low cost. As their motive is entirely wrong, it is fair to say that they get far from one hundred cents for each dollar spent for this purpose. If one is not interested in the safety of his plant, it would be much wiser only to purchase ample insurance at the best price obtainable, as by purchasing protection, which neither he nor his employes are interested in, only serves to deceive him and others as to the safety of the plant, and he is likely to find some morning that his property is a total loss and his sense of false security has led him to neglect full coverage by insurance. The most intelligent purchasers of insurance, purchase fire protection and prevention service with their policies, and they do this by dealing with any of the large, reliable companies.

It was not long ago that fire protection hardly existed, although history reports an occasional attempt to reduce losses. Even fire insurance was unknown up to the time of the great London fire. The appreciation of the unwisdom of burning up a large percentage of our annual efforts is steadily gaining ground and the demands of fire protection are much more considered today than they ever were before. Possibly it is unfortunate that fire protection engineering and service are so involved with the insurance business. If manufacturers bought fire protection engineering separately as they do other engineering service, they would, without doubt, appreciate it at least to the extent indicated by the price of the engineer's bill.

In the old days insurance companies operated the fire departments and tried to put out the fires themselves, but soon it became evident that fires were a public calamity and the public now cheerfully assumes the cost of extinguishing fires, the insurance companies paying the losses only. This is one of the fruits of a general educational campaign, which is still being carried on, the efforts at present being turned toward prevention of losses, as is evidenced by the adoption of building laws by many cities, and other ordinances tending to prevent loss by fire. The insurance companies now pay for fire prevention largely, this being done through their educational organizations and through their inspection service. Gradually prevention will also be further assumed by the public and already many fire departments undertake inspection work which has been very fruitful in results. It is also safe to assume that some day the cost of extinguishing fires will be paid for solely by the person responsible for the fire, and some states already have adopted, and others are considering, laws putting this principle into effect. It may also be assumed that eventually the person having a fire which extends to and damages other people's property, will have to pay for their loss also. It is therefore evident that public education along the lines of safety from fire, must become more and more a necessity.

In France, one takes out insurance to protect against suits from his neighbors. If one burns his own house and it extends to the neighbor, the neighbor can collect from him, so the property owner takes out insurance to protect his neighbor as well as himself.

In these remarks I have tried to show the "Why" of fire protection. Let us now turn our attention to the "How" of fire protection, or the practical means for bringing it about aside from providing indemnity in the form of insurance, which, as I have explained, can only partially meet the problem.

There are very definite protective measures which an owner of property may control whereby he may directly govern the degree of his safety and incidentally the cost of his indemnity. There are four factors beside that of indemnity which govern the safety of a plant against fire loss. They are *exposure, construction, occupancy* and *protection*. The latter may be presumed to include also prevention.

Exposure:

The term "exposure" signifies the possibility of a property being damaged by a fire in one or more of its neighbors. It is important, therefore, that in locating a plant, this feature of safety from fire be considered so far as possible. It is somewhat ridiculous to build an excellent fireproof plant within a few feet of some very highly inflammable buildings. There are methods of guarding against such exposures but they are expensive. Such a poor location may result in the new plant being put out of business entirely at any moment. A large and long established cotton mill in Massachusetts was entirely burned because it neglected to purchase sufficient land and keep it free of buildings, with the result that many acres of highly inflammable wooden tenement buildings accumulated around it, and when they burned the entire mill was carried away with them, although it was one of the best protected mills in the country. It is always well to avoid building directly up to the property line, because one never can tell what the future may bring forth as to the character of his neighbors. All important industrial plants should be placed on liberal sized lots, well fenced, with ample space all around the buildings.

If of necessity there must be an exposure, there is quite likely to be a charge for it on the insurance cost and the protection against it will also be expensive. Very little can be done along prevention lines to guard against the exposure danger.

The new, modern, fireproof buildings, which are largely built of glass are not very fireproof. They are like greenhouses. If a fire occurs under their windows it immediately guts the whole building, all floors at once. In the old days with the old-fashioned mill where the glass area was about one-fifth of what it is now, our ordinary means of protection would successfully keep exposing fires out of those windows. One or two sprinklers would open and keep it out. The modern type of building, with walls often about eighty per cent glass, does not stand any such fire. If there is a fire anywhere near it the glass immediately falls out and the building is gutted, with a total loss of contents. The steel window frames seem to stand much less exposure than even heavy wooden frames. They expand with the heat and throw the glass out before it is broken by expansion. They will bulge outward, from a foot to eighteen or twenty inches, throwing the glass with them, and leaving the whole room open to the fire brands. If there is painting and enameling or such work inside the rooms are immediately set on fire with very disastrous results. Exposure is a very vital factor in locating buildings with this type of window.

It is almost impossible to provide any protection for these large windows. We could shutter the old style windows, we could put wire glass in them, or we could protect them with open sprinklers. We cannot shutter the new style windows. There is not wall space enough left against which the shutters may be folded. They are too large to make wire glass practical, both from the standpoint of expense and also from the standpoint of protection. There is not water enough available to sprinkle those windows sufficiently to cool the air which would come in from the fire, if they broke out.

Construction:

The reason that construction is very important when considering fire protection, is that it is a direct measure of the speed or rate of burning. The more slowly a building burns, the more chances there are of a fire being extinguished within it. This is the principle which governs fire insurance companies in measuring the cost of indemnity in accordance with the excellence of the construction. That, of course, is self-evident. If the building will burn in an hour there is twice the chance of saving some of it than there is if it burns in half an hour.

A light wooden building will burn rapidly, and if it has hollow ceilings and walls and blind attics, it will burn more rapidly. A heavily timbered wooden building will burn much more slowly than the first named type, and a brick building of this type will burn still slower. An all-steel building has the advantage of not spreading fire in itself, but it might quite quickly collapse if it contained inflammables on fire. Modern reinforced concrete, and other types of fireproof construction, will stand a great deal of fire, although when having inflammable contents burned out, the loss on the buildings may reach 20 to 50 per cent.

Very fine manufacturing plants are often turned over by contracting engineers and the owners to production men who are to carry on the industry. The production men then proceed to ruin the whole plant by filling it with wooden partitions, closets, shelving and other unnecessary inflammable things, and by erecting additions called by them "temporary structures." These often are nothing more than wooden sheds or shacks absolutely out of place in any manufacturing plant. These structures are erected under the false idea that they are necessary to fill an immediate need, or with the idea that money is saved by their erection. More often they are the result of a whim of some minor department head who thinks he wants a private office or a little more room. Many excellent plants have been spoiled in this way and a great many destroyed by fires starting in such poorly built structures. When they are built, the insurance companies cannot be just to themselves if they continue to issue indemnity on the plant at the same price as formerly, and even if this is not done, the cost of the extra protection necessary to maintain the original safety is often more than would have been the cost of erecting the new structures in a proper manner. Many plants today have "temporary" structures which have been in existence twenty years. There should be no such term in the vocabulary of a skillful plant manager, for anything that is worth doing at all, is certainly worth doing well.

One of the serious defects in construction from a fire protection standpoint, is the presence of openings through floors, such as stairways, elevators, belt holes, etc. Fire and heat travel upward a great many times faster than they do horizontally and it is almost impossible to extinguish a fire in a combustible building where there are means of communication permitting the fire to travel vertically. Floors should be intact throughout, all elevators and stairways being well inclosed, so as to retard the fire. There is much more chance of a fire being put out if its progress is stopped even temporarily by a partition. Vertical openings through floors also prevent the proper heating and ventilating of a factory and in general present other undesirable features, one of the most important being the danger to lives of employes working in the upper stories. Buildings bearing heavy loads should be well posted, trusses, trussed rods and tierods being avoided so far as possible as all such structures prove to be weak points at the time of fire and aid in the early collapse of a building.

I recall a spring shop in Worcester, Mass. It was a steel building with a distance of about forty feet from the brick floor to the roof trusses. The only thing that could burn in it was the planks on the trusses, some fuel oil used in the furnaces and the brick floor which was saturated more or less with fuel oil. But it did get afire one day, some spilled oil and the bricks burning so rapidly that in about forty minutes the steel building, having girders up to eighteen inches deep, was a tangled mass of steel. In those days we didn't have acetylene torches to disassemble huge steel members and you can imagine the cost to clear that wreckage away, in addition to the loss of the building.

Occupancy:

Given a good factory plant of excellent construction, the next problem is to house the processes in a safe manner. One of the first principles of good occupancy so far as fire protection is concerned, is to separate high values from hazardous processes. This is unknown language to the average modern production specialist in some of our newer industries, although it has long been considered essential to manufacturing success in the older industries, such as cotton and woolen manufacturing. It is a ridiculous proceeding to scour the world for raw products, bringing them over oceans and continents at much difficulty and expense, and then store them in the same room with a large tank of naphtha, oil furnaces or some other such fire hazard which can destroy them in a few minutes. But, however ridiculous it appears, it is actually a custom, the writer have very recently seen nearly half a million dollars' worth of rubber stored under just such conditions. It is equally ridiculous and possibly criminal to work on these goods, applying to them very expensive processes involving the present high labor and overhead charges, and then storing all these finished goods or finished parts where they may be subject to a severe or total loss if something happens to strike a spark in that location. Some of our production specialists are so very apt in specialization that they will even argue that this is necessary and essential to their busines, and probably their inability to see the matter in its full relation to continued production is excusable. It is safe to say, that usually when we appeal to the president of the concern on such matters, he, being interested and responsible for the plant from financial, production and all other standpoints, will readily agree to the necessary remedy, and very likely this indicates the reason why he is the president of the plant rather than a subordinate.

Occupancy of a factory is largely a matter of style and habit, and to a large extent this also applies to construction. One of the largest leather tanning towns in the world, until very recently, had all its tanneries of about the same style of construction and the rooms were occupied in about an identical way, although neither the style of building nor the arrangement of occupancy was best adapted to economy in production. The essentials of safe occupancy are very simple and are based upon the idea that the loss of any part of the plant should not cripple it as a whole. Raw stocks essential to the continuity of the business should be stored in a separate building, or at least one cut off with a reliable fire wall from the other buildings, and in the most economically run shops these buildings are usually unheated in order to save the cost of heating. Sometimes some goods must be kept warm, and if that be the case, portions of the storehouses may be provided with heating facilities. There should be separate storage buildings for the finished goods awaiting shipment. It should obviously be unwise to store finished goods and raw stock in the same building, because if the building were lost, the manufacturing departments would be shut down for lack of stock and the sales would have to stop because of the destruction of the finished product. By keeping these two classes of storage separate, the safety of the business is doubly guarded.

In the manufacturing plant itself it is well to have several buildings and duplicate the work so much as possible, but this is not necessary under superior construction and non-hazardous occupancy. The proper safety measure to take in such cases is to absolutely cut off with fire walls all minor dangerous processes. If the dangerous processes involve a relatively large manufacturing area, they should be segregated entirely. A great danger from losses and stoppage of a production department lies in the fact that the hazardous processes where fires are daily expected may be so poorly located that when fires occur, they destroy or damage other important production departments from which they are separated in no way. So far as possible, hazardous work should be conducted in one-story buildings, because, if located on lower floors of high buildings, the fire is apt to pass to the rooms above, either inside or around through the windows, and if the hazardous work is located on the upper floors, there is unnecessary and unfortunate water damage resulting from the extinguishing of the fire in such processes, as the water passes to the floors below, damaging stock where there is no fire.

Some people think that a fireproof building is also waterproof. I was in a ten-story reinforced concrete tannery once, and I happened to be on the upper floor when a water pipe broke. In a few moments the floor became a little pond. I continued inspection of the building, and by the time I got to the basement that water was down there, too. It is fair to state that the building was one of the early concrete buildings, and had the cinder mixture, which might have made a considerable difference, but we do get water damage even in our most modern fireproof buildings.

Protection:

The fire protection required for any particular building or occupancy varies, or should vary, with the construction and occupancy. Highly inflammable buildings and hazardous occupancies naturally demand larger amounts of water for extinguishing fires than do fireproof machine shops. For this reason each plant is a separate problem from the standpoint of a fire protection engineer and all the modern safeguards are applied to the degree that occasion demands, the sole object being to strike a balance of safety so that the chances of the plant being destroyed or seriously injured by fire are minimized as far as possible. Because of the present, typical American attitude of carelessness against fire, it is necessary to equip practically all portions of most industrial plants with automatic sprinklers to insure safety. These devices work automatically to extinguish fire without human aid, and have been eminently successful in protecting large industries, and indeed are a factor in making some industries successes. One of the mistakes we have made is in not keeping our standard protection up to the requirements called for by the increase in production and hazards as is manifested today. As areas, hazards and values increase, more care must be taken to make the fire protection as efficient as formerly and it may be safely assumed that the water supplies for fire fighting purposes must increase in accordance therewith unless radical measures for reducing hazards are adopted.

Automatic sprinklers are supplied with water by large elevated tanks, by city water pipes and by fire pumps. There is also much to be gained by installing standpipes and hose throughout all manufacturing rooms as practically all classes of labor are familiar with their use. The addition of modern chemical extinguishers is also desirable to permit employes familiar with their use to extinguish fires in their incipiency.

It is a useless expense to install elaborate fire apparatus if it is not kept in good order and if men are not kept familiar with its uses. Large industrial plants should always have a trained fire brigade among their employes with arrangements made whereby they may be made available day or night. Our public fire departments in a great many cities and towns are less efficient today than formerly and a well conducted manufacturing plant should plan its protection so as to be practically independent of any such outside aid.

Alarm Service:

The one branch of fire protection which needs to be mentioned is the alarm system. It is very important, a fire having occurred, that it be very promptly discovered. We all know that a fire at its start is a very small affair. It may be only the size of a match flame, it often is. But give the fire 10 seconds, 30 seconds, 60 seconds, 5 minutes or half an hour and the flames soon get beyond control. Automatic alarms are used a great deal in city properties; so-called thermostats, which, when a fire occurs and raises the temperature of the room, automatically transmit an alarm to some central station. Those are not used much in manufacturing plants. There can be attached to a sprinkler system a so-called alarm valve, which operates to ring bells wherever desired in case of any sprinkler opening, and they are more or less reliable. The thing relied on most in large manufacturing plants is a good corps of watchmen. Of late years we have been making a drive to increase the efficiency of that alarm service. (In the old days a watchman was put on to suit the insurance companies.) He had one arm and two wooden legs maybe, but that was all right. But as values increased and plants became larger, the manufacturers saw that it was not economy to leave things in charge of such a man. Sometimes it is almost impossible to get within the gate of a large manufacturing plant in the daytime, but if you call there between 1 and 3 a. m. you can have the liberty of the plant without trouble. It is surprising how manufacturers will leave properties worth millions of dollars in charge of men who used to be paid fifteen or twenty dollars a week.

A good reliable watchman's service, with records of the rounds whereby the service can be checked, is a very reliable means for not only discovering fires, but for discovering causes of fire and eliminating them before the fire occurs.

There should always be means, in case a fire is discovered, of bringing aid. Usually people are told and trained to call aid the first thing they do in case of fire. I am in a way a radical in regard to that matter. I don't believe in it. I think that a great deal of property is destroyed because people get excited and run half a mile to the fire alarm box to get the fire department, when by promptly stepping with their foot on the fire they would put it out. We want to educate people, in regard to fire, to jump on it quickly. In the old days of fire protection in New England fires frequently started in cotton mills. The cotton mills had largely English help and you know John Bull doesn't move very fast, but he does move methodically, and when he saw a fire start he would probably casually walk over and put it out. The modern central European type of laborer, in the cotton mills, sees the same fire and his hands go in the air and he yells and he, with all the others, go out very much excited, leaving the mill to burn. The character of the labor in our mills is a realy measurable factor of fire losses, as insurance companies find in writing some classes of business, and if we can train people to jump on a fire promptly it will do a great deal if their judgment can also be trained to judge the size of the fire and whether or not they can control it. Then they will readily call the fire department and outside aid if they know they cannot put it out, but the main thing is to jump on the fire. The irresponsibility of modern factory help can be illustrated in two ways by two cases which have come to my attention lately.

In one fire the factory had just gone through a strike, and as it burned going into the heavens in smoke and flame, the help stood across the street and cheered, and I have heard there was an attempt to form a parade in honor of the occasion.

I was in a factory the other day where, at noon hour, some of this modern "don't-work-unless-you-are-paid-for-it" type of labor is employed. They were eating their luncheons. Some oily rags started a fire near by and the fire ran up the partition, spreading as it went. The fellows looked at it and kept on eating their bread and butter. It finally got pretty smoky there, but they stuck it out; you see they were on piece work; they were not paid to fight a fire, so why not let it burn? Finally the fire opened the sprinklers and then they moved when the water came down on them.

I do not want to disparage in any way the value of calling the fire department. Every plant should have its own fire alarm box so that the watchman in the middle of the night can call his own fire brigade either through his private system or by blowing the whistle, as the case may be, and also at the same time provide for calling the fire department. In the best managed plants that is done, the man being delegated to open the factory gates and direct the fire department as it arrives to the spot where the fire is located.

It might be well here to explain the attitude we take toward protection. The attitude of the average property owner is, "I can't have a fire here." The fire protection engineer knows that is a fallacy. We assume a fire will start anywhere at any time, as it does, and we decide how much protection is needed for that particular spot to keep the fire from causing further damage. I remember one large industrial plant that was equipped with modern fire appliances throughout, but the president and officers, having a very richly paneled mahogany office, furnished with expensive appliances, objected strenuously to putting sprinklers in their office. They didn't want to see the sprinklers sticking down through the ceiling even if the pipe were concealed. The factory protection had not been in service very long before the President stayed to work one night in this elaborate office. As he went out he tossed his cigar into the waste basket. About half an hour later the fire department put four hose streams through the windows of his beautiful office. It wasn't so beautiful in the morning. That shows there is no spot in a plant that is not subject to fire. That is our attitude and our assumption. We had a loss the other day in a fireproof room used for the storage of bar steel. We paid them over a thousand dollars loss. Somebody left something in the room that didn't belong there—temporarily. It probably would not happen once in a lifetime, but it happened at that moment. . . .

In summing up this talk, let us reverse the program upon which it has been based and start with prevention. Fires are always caused by something out of place, therefore cleanliness and orderliness are essentials of safety. Continual watchfulness on the part of the management and on the part of the department specifically charged with this work is essential. Assuming that all preventive measures have failed and a fire has started, as of course must happen almost daily in some industries with hazardous processes, then fire protection comes into play, and all efforts should be directed to a prompt discovery of the fire and its prompt extinguishment before it gains headway. Assuming this to fail, then there should be the second line of defense brought to bear, which involves the operation of sprinklers, pumps and hose streams, and should a fire reach this stage, it is time to go through all the buildings and make sure that all fire doors, windows and skylights are closed so as to guard the buildings near the one on fire against the exposure to the flames. Even with the very best that can be done, there are bound to be failures from time to time and the piles of ashes representing the total losses of some of our large industries continue to accumulate. Each manufacturer feels assured that he will not be the next victim, and often even specialists in fire protection are surprised that certain properties are destroyed. The remedy for all is eternal vigilance and full coöperation between the manufacturer, his department heads, the insurance companies, and all their fire protection representatives. Even with this united stand there are bound to be failures, but in the long run much will be saved.

DISCUSSION.

Mr. Kettler: There is one hazard I don't think Mr. Richards touched on in his paper, and that is the hazard of life, due, not to fire, but due to faulty engineering on certain construction. I refer to the tanks and reservoirs on the tops of some of our buildings. I am particularly familiar with that work, having been with the Chief Engineer of one concern in the city here for twelve years. A good many of the architects, especially the older architects who came in under the present architect's law without taking the examination, are at present incompetent to handle work of that sort. Only today I was compelled to turn down the installation of a fifty-thousand gallon tank and tower on top of a building—not in the city of Chicago—that has been passed on by the architect, designed by the architect, and passed upon by the building department of that city. It is not only unsafe, but should the water be turned in there, before they had it three-quarters full it would fall, without doubt. There are firms employing girls and women in offices under that tower. That is certainly a worthy part of this fire equipment, especially should engineers consider it. I do not think our engineers would overlook that, but the architects, not all of them, but a good many of the older ones, take those loads too lightly. They consider them the same as building loads and they are certainly not the same. When fifty thousand gallons of water are in the reservoir there is a fifty thousand gallon load. This is a big factor in fire protection and should receive more consideration.

CLOSURE PRESENTED BY BENJAMIN RICHARDS.

We would regard cars on a siding just the same as an unsprinkled shed beside a building. I have reason to believe that quite a number of fires start in such cars. Of course, it depends upon what is in the box cars. If they are filled with your own goods awaiting shipment, the danger is measurable by the contents. There is also the usual and ordinary exposure from the locomotives coming in to take the cars away. The car itself is an exposure, but I am free to say that the records do not show a high amount of such losses. One of the great troubles with freight cars left between buildings is the obstruction they cause to fire fighting apparatus. We have a great deal of trouble because they block the hydrants. If the cars are right close to the building, the hydrants are often beyond them, making it hard to get the hose in service. Sometimes a freight train will pull up alongside a factory and cars will be left there containing very highly inflammable materials. A whole side of a cotton mill was blown out during the war by the explosion of a car of TNT. There are not many such cases, but there is always the possibility.

I did not make it clear purposely, because it is not so true today as it used to be that manufacturers who put in protection cut down the cost of their insurance, and therefore the rate is much less than it would be if they had not made that investment. There was a time when the difference saved in the insurance rate by putting in sprinklers and modern fire protection gave a man about 30 per cent on his money invested. We could never understand why he preferred to pay the insurance companies the excess rate when he could easily save it himself. At present that is not so true. The cost of labor, steel pipe, fire pumps and tanks that are required to equip a plant today; puts the protection in the class of a safeguard to yourself rather than a profit on insurance. Undoubtedly, in the future, many manufacturing plants will be of fireproof structures with non-inflammable occupancy and no sprinklers. It will be cheaper. That manufacturer may have to pay a little more money for insurance, but it will be much cheaper for him than to put in all the modern protection. But he must make sure that he is safeguarding his investors. There was a day when the fellow selling fire protection devices didn't have to advertise. The devices sold themselves. The insurance companies sold them for them, by the profit in putting them in. But now you will see fire appliances advertised throughout our leading magazines. They have to sell them just like Ivory Soap or anything else. How long that will last will depend entirely on the prices.

We can tell you very surely that the cost of insurance can't be doubled in price. It is the only commodity that has gone down in price in the last five years.

We discourage tanks on buildings all we can. Some men insist on them. I think it is the most expensive place to put the tanks. I hope some day cities will supply sufficient water service so that these tanks can all be eliminated. This middle west territory, especially, has poor water pressure and small pipes, and if, as is generally granted, fire protection is a public utility, it is certainly proper for any municipality to provide a proper water supply.

An aluminum compound has been used successfully for a great many years in protecting oil tanks against fire. The danger of putting water on an oil fire, of course, is that the liquid will overflow and spread the fire. This foam is formed by chemical action and is forced out of the extinguisher by carbon-dioxide gas. It flows over the tank, which is on fire, and cuts off the further generation of gases. If the tank is hot, there is a gas generating zone above the liquid, and this foam flows over and stops the generation of gas by detaching the fire from the liquid. A fire can be put out by detachment just as well as by lowering the ignition point.

You can draw a newspaper over the top of a pail of burning naphtha and put it right out. Those are the easiest fires to put out. We are using foam now in industries for the protection of large dip tanks entailing the use of highly inflammable volatiles, like those used in the automobile industry. The stock comes through continuously all day long, on conveyors. It is dropped down into the dip tank, taken out again and goes on to the driers. The old way of protecting dip tanks was an automatic cover, arranged to drop down on the tank just before the sprinklers opened. If this did not work the sprinklers might overflow the tank and overflow the burning oil. These new tanks containing the conveyors cannot be covered, because the conveyor machinery is in the way, so we open a valve and let the highly inflammable contents down into another tank, so that when the sprinklers go off they can keep the steel conveying machinery cool. The drainage prevents overflowing the tank. Then, as a third safeguard, we adopt this foam extinguisher. In one plant in Detroit they have just installed an automatic device on tanks which hold this aluminum compound. If the dip tank gets on fire the foam works automatically as does a sprinkler system.

The mechanical limitations of the process and devices are such that the foam cannot be applied over large surfaces. If they were going to treat a tank fifty or sixty feet in diameter, they would have to have five or six large machines with very large spouts on them. But where you have highly inflammable oil in small confines that may flow around, the foam works well.

Every engineer can spend a very profitable afternoon by visiting the Underwriters' Laboratories in E. Ohio Street. In the first place, you will find a very original building there. You will find an absolutely fire-proof building. There is little or no wood in it. Most of the furniture is non-combustible also. The laboratory started in a very small way, as a wire inspection bureau a few years ago, the whole thing being a monument to Mr. William H. Merrill's energy and imagination. I asked Mr. Merrill last year how many underwriters' labels they sold last year, and he said there were so many, they couldn't count them at all. As you know, when electricity first came into our buildings, electric lighting was very carelessly done; wires and wiring consisted of almost anything. Supports were wood, cleats were wood, everything was put in badly. The laboratories standardized wires and the work extended into approving all sorts of devices for fire protection. Any manufacturer can take his device there and have it submitted to the same regular tests as his competitors have enjoyed. If, after consultation with the engineers and studying results of the tests and making improvements here and there, he can get his device or apparatus labeled, which is a great thing for him, because it practically sells his goods for him, he can meet all competition. Anything bearing the Underwriters' label largely sells itself automatically. Manufacturers wanting the proper materials as they relate to fire apparatus simply specify in the contracts that their hose, their chemicals, anything that they want to buy in that line bear the Underwriters' label. That is sufficient. The government bought millions of dollars worth of supplies for the war with no other contract. Hose was sent to France by the millions of feet with only that specification made. Millions of rolls of roofing paper were sold to the government, under contract that it bear the Underwriters' label, because that label meant quality. They stand back of it. Experience has shown that changes in designs are necessary from time to time; the label service can't necessarily go into the future and have imagination, but as a rule everything labeled is a first class product. The laboratory has very large branches in chemical research, hydraulic laboratories and all other necessary branches. They analyze the rubber in the hose, they test the cotton and linen yarns from which the hose is made. They test the sprinklers. No sprinkler can be put on the market and have the Underwriters' approval until it has gone through the regular tests, although anybody can take his devices in at any time and have them subjected to tests. The laboratories also send engineers into the field to check the manufacturer on the ground. If you are running a mill and have bought fire hose, perhaps the laboratory inspector will call on you and say, "Ship that length of hose in to the laboratory; I want to check it." I have just sent to the laboratories lately at the suggestion of one of our clients a shipment of fire extinguishers which they thought were not standing up as they thought they should. If we are assured their claim is correct, the manufacturer will be asked to replace them all at his own expense.

The hydraulic laboratory is especially interesting. Lately, in the last three or four years, they have been coöperating with the Bureau of Standards in Washington in testing steel and they are working out scientific formulae and tables for the strengths of different steel members. They have costly machines there—I believe one of them cost $75,000—for testing steel columns, reinforced concrete columns, and terra-cotta protected columns when subjected to different degrees of heat in the furnace. All is especially designed machinery, costing a great deal of money. Through coöperation with the Bureau of Standards they have saved money for the companies and also the government by conducting the tests jointly. Really, the Underwriters' Laboratories is a subject needing a whole evening's lecture and discussion.

April 5, 1920

What Should Be Done to Increase the Civil Use of Airplanes?

By John F. Hayford, M. W. S. E.

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THE GREAT WAR is over. One of its incidental results was a greatly accelerated development of the art of flying and of aircraft construction.

Obviously, it is important now to concentrate on the development of the civil use of aircraft. It has been desirable during the past year to push as rapidly as possible with such development in order to salvage the war training of flyers and airplane mechanics, to salvage the aircraft already built, and to salvage some of the industrial plants engaged in aircraft construction. These were relatively temporary considerations. The civil use of aircraft should be developed for the sake of that use itself. Last, but not least, it is important to develop the civil use of aircraft in the United States in order to make it feasible for us promptly to build, organize, and use a great and effective air fleet in the event of another war. The less we do in the air in time of peace, the more limited will be our power in the air in time of war.

We might start the development of the civil use of aircraft with glowing predictions, and with a belief that as the locomotive and steamship did wonders that are now commonplace, so the aircraft are necessarily destined to do likewise. But a nation, or a man, is apt to succeed best in anything if the start is made by looking clear-eyed and sanely at the possibilities, and by weighing the difficulties, and if the progress is sought by energetic, patient effort. The time for the shouting is after the accomplishment.

What are the prospects as to the development of the civil use of airplanes? What are the difficulties which need to be overcome first, or soon? What are some of the changes in design, or the new inventions that are evidently needed? .Let me indicate some of the high points in the answers to these questions.

In any undertaking in which the co-operation of large numbers of people is necessary to secure success, one of the necessary preliminary steps is to promote interest in that undertaking. Such statements as the following have been much used for promoting interest in the development and use of aircraft. I quote from a publication dated February, 1919:*

"The members of the Manufacturers Aircraft Association are looking ahead to greater achievements in times of peace for the airplane, than the wonderful achievements in time of war. They are looking forward to the day when American aircraft, of both land

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*Aircraft Year Book, issued by The Manufacturers Aircraft Association, 1919 (501 Fifth Avenue, New York City) pages 12-13.

and water types, shall have made American ideas and American goods familiar and necessary to people in every part of the world. They foresee—and need not look so very far ahead of the rest of us—the time when the great burden of transportation shall be lifted from the crowded tracks of commerce to the free spaces of the air.

"These men are certain of aerial mail and passenger and express routes connecting New York in a 40-hour schedule with Seattle and San Francisco. They know that very soon the most inaccessible mining cabin and the most distant rancher's hut will be reached by the aerial mail. They realize now that world routes must be established and that supremacy on land or sea is not of so great importance as supremacy of the air.

"Surely the power to demonstrate the truth of their vision is not lacking. Judge the certainty of the future in measuring past accomplishments. The manufacturers of American aircraft are well content to let past deeds indicate future possibilities."

I assume that by this, and similar statements, your interest has been fully aroused,—in fact was fully aroused many months ago. I assume that you have expected much more progress in the development of the civil use of airplanes than has occurred in 1919, since the statement just quoted was printed. I assume that you would like now to see both the possibilities and the difficulties and to see them sanely and clearly.

"The manufacturers of American aircraft are well content to let past deeds indicate future possibilities." That sentence was written with a pride which was entirely justified by the facts.

A British report made to Parliament for the year 1917 by the War Cabinet* contains the statement, "Experience shows that, as a rule, from the date of the conception and the design of an aero-engine to the delivery of the first engine in a series by the manufacturer more than a year elapses." The Liberty Engine was conceived, designed, and the first twenty-two engines built in seven months, June to December, 1917. By the date of the signing of the armistice in November, 1918, 14,000 Liberty Engines had been built, and 4,500 per month were then being built.**

There was an embryo airplane industry in the United States in 1916 and up to the entry of the United States into the war in April of 1917. In England, in 1916, 100,000 people were engaged in the airplane industry. Yet the United States produced airplanes as rapidly in 1918 as England had produced them in 1917. In other words, starting more than two and one-half years behind England in 1917 in the development of airplane industry, the United States, had, in rate of production, before the end of 1918, come up to within less than one year of being even with England.

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*A part of this report was republished in Smithsonian Miscellaneous Collection, Vol. 69, No. 7, under the title, "Report on Aircraft Supply of Great Britain and Discussions of the Difficulties Involved in Production."

**United States Army Aircraft Production Facts, compiled at the request of the Assistant Secretary of War by Col. G. W. Mixter and Lieut. H. H. Emmons, January, 1919 (Government Printing Office), pp. 16-23, for information as to the Liberty Engines, and pp. 54-55 for information as to production of airplanes. Aeronautics in the United States at the Signing of the Armistice November 11, 1918, an address before the American Institute of Electrical Engineers by George Owen Squier, Ph.D. (January 10, 1919), published by the Institute. See page 12 for the rate of production of the Liberty Engines.

The manufacturers of aircraft in the United States may well point with pride to their achievement in producing airplanes and airplane engines quickly and well.

The power to produce airplanes and their equipment, including engines, is surely far in excess at the present time in the United States of any civil demand for the airplanes. Why then is the civil use being developed so much slower than one would naturally expect from the quoted prediction of the Manufacturers' Aircraft Association dated February, 1919?

That prediction included the statement, "that they foresee,—and need not look so very far ahead of the rest of us,—the time when the great burden of transportation shall be lifted from the crowded tracks of commerce to the free spaces of the air." That gives us a vision, for example, of "the great burden of transportation," the great masses of coal and other freight, lifted from such "crowded tracks of commerce" as the Pennsylvania Railroad between Pittsburgh and Harrisburg and carried through "the free spaces of the air" on aircraft.

What is the progress to date toward commercial possibilities of airplanes carrying freight of any class?

The British airplanes produced in large numbers during the war cost more than $4.00 per pound of gross weight of the whole airplane and its load when fully loaded. The cost of American airplanes now reckoned on the same basis is, so far as I am able to ascertain, from $1.00 to $4.00 per pound of gross weight of the airplane and all of its accessories including its load. The cost of a railroad freight train, measured on the same basis, is probably less than 5c per pound. The ratio of these first costs is from 20:1 to 80:1,—against the airplane. The maintenance costs are in a similar relation,—extremely high for aircraft. The ratio of useful load,—the cargo load,—to gross weight is less than 1:2 for an airplane, usually very much less under service conditions. On a railroad freight train fully loaded, much more than one?half is useful load. The tractive effort necessary to pull an airplane forward through the air is more than ten times as great per pound of gross weight as it is for a railroad freight train. The airplane will cost on a 20 per cent grade, the freight train on a grade of less than 2 per cent. The unit fuel cost tends to be proportional to the ratio of tractive effort to total weight even if like grades of fuel are used in the two cases, but a locomotive burns low-grade coal and the airplane engine high-grade gasoline. The crew of a long freight train carrying many hundreds of tons of freight is five or six men. The crew of airplanes for heavy carrying now averages not far from one man per ton carried. In brief, for a given output in ton-miles of freight carried, the first cost of an airplane is several times as great as that of a railroad freight train, and the same is true of the cost of maintenance, the cost of fuel, and the cost for crews for operation.

In the most extensive and successful regular service by airplanes in carrying material, known to me to date, namely, the carrying of mail in the United States, the cost has been on an average between 0.1 of a cent and one cent per pound-mile. On a freight train the cost of carrying freight is between 0.1 and one cent per ton-mile. Roughly speaking then, it costs about as much now to carry a pound of freight one mile on an airplane as to carry a ton of freight one mile on a freight train—a 2000:1 ratio.

Of course, the airplane is in its infancy and the freight train is a mature giant. Nevertheless the discrepancy is so great that it apparently limits the commercial possibilities of airplanes for freight carrying to a very small amount of high-class freight, in fact to the very highest class of parcel express, and then only to those classes in which quick delivery is extremely important. Note that the emphasis is put on quick delivery—that is, on high speed—as the condition which gives the airplane the advantage on very small amounts of the highest class of express, and this only.

If the dirigible balloon is substituted for the airplane the cost per ton-mile would be greatly reduced, yet will still be far above that for railroad trains or steamships, but the advantage of the reduction in cost per ton-mile gained by changing from the airplane to the balloon will be largely lost by the reduction in speed. The dependable speed of a dirigible is not much above that of a freight train. Hence, the commercial possibilities of the dirigible for freight or express carrying,—or that of any other lighter-than-air machines, —are apparently very limited.

How about the use of airplanes for carrying mail? The possibilities here are much more promising than for freight or express because mail is light in proportion to its value, and speed is very important.

The best demonstration in the world today of the possibilities of mail carrying by airplane, and indeed of the possibilities of any regular transportation of commodities by airplane, has been made under the Post Office Department in the United States. There has been a daily mail service, one airplane each way per day, between Washington and New York via Philadelphia since May 15, 1918. There has been a similar daily service between Chicago and Cleveland since May 15, 1919. It is proposed as soon as feasible to extend this route over the whole distance between Chicago and New York for regular service.

On the Washington-New York route, for the first year, the experience has been that the overhead cost was 28c per airplane mile, the operating cost 20c per airplane mile, and the maintenance cost 41c per airplane mile,—a total of 89c per airplane mile.* The average useful load of mail carried was 160 pounds, and the total cost was therefore 0.6c per pound-mile. It is clear from the experience of this first year, and recent experience, that the average cost per pound-mile can be reduced considerably below the figure named.

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*Report on Airplane Mail Service, Washington-Philadelphia-New York Route, for year of May 15, 1918 to May 15, 1919, published by the Post Office Department.

As to reliability of service, one should note that 93 per cent of the possible trips, one each way per day, were completed,—only 7 per cent of failure. Of this 7 per cent more than one-half was caused by failure to start in the face of very adverse conditions, and the remainder by failure to arrive after the start was made. Please remember that this service continued throughout the winter of 1918-19, and included some flights in gales of more than fifty miles per hour,—one with a maximum of 68 miles per hour.

As to safety,—the record of the airplane mail service for the first year, on 128,000 miles of flying, was two deaths, two serious injuries, and six minor injuries. This safety record, combined with the reliability records just stated marks this first year's performance of the airplane mail service as establishing a new epoch in the history of aviation. It is a performance not equalled anywhere in the world today so far as I know. Great credit is due to Mr. Otto Praeger, Second Assistant Postmaster General, and those associated with him in this work. The permanent benefit of this achievement to aeronautics is, in my opinion, even greater than its benefits to the mail service.

There is some mail over many routes, and possibly all the mail over some routes, that can afford to pay one-half cent per pound-mile. There are routes in Alaska over which people would be delighted to get all their mail, especially in winter, at that rate. It costs $40 per hundred words to send a cable message from London to Johannesburg in South Africa, and it takes 24 hours on an average for the message to get there. If a regular mail service by airplane were established between these same points, it is estimated by the English that a 5000-word letter would get through in six days at a cost of 60c. Such an airplane mail service would probably prove to be a healthy commercial rival of the cable service.

For reasons which I will leave you to figure out, mail service over land by airplane has little advantage over train service in a well-developed country unless the distance exceeds 300 miles. In general, the longer the distance and the greater the water barrier the greater is the advantage of the airplane.

There are opportunities for great extensions of the airplane mail service which may be commercially justified, as indicated. Clearly such extensions should be made.

What about the use of airplanes for carrying passengers? The freight cost already considered, about one-half cent per pound-mile, amounts to about 75c per passenger-mile, which is roughly thirty times the cost per passenger-mile on railway trains. Even though the airplane cost is divided by two or three in the next few years, the commercial possibilities for the airplane will be limited to certain special cases constituting a small percentage of the total passenger traffic. For these special cases the airplanes will probably succeed, commercially, soon. People will ride in airplanes for sport, and for the sake of a new experience. By airplane it will be possible for a business man to travel to a point 500 miles away, do two or three hours of business, and get back on the same day. He may often be willing to pay the price. A man may be willing to pay the airplane price to reach a sick bed. For diplomatic reasons it may sometimes be worth while for government officials or confidential messengers to travel over long distances by airplane to save time. It is estimated that a passenger may be carried from London to Calcutta by airplane in four days. It takes sixteen days at present. An airplane has made the flight from London to Calcutta successfully.

Until airplanes and their methods of operation have been greatly improved the danger to life will be an appreciable handicap against airplane passenger service. The passenger in an airplane is in nearly as much danger as the pilot. In the first year of airplane mail service in the United States the safety record of one death for each 64,000 miles flown was very much better than any previous safety record for air navigation. With improved machines and improved technique of operation the degree of safety will doubtless increase greatly, but it will probably be impossible for a long time yet to equal the records of safety of railroad trains and steamships.

The airplane has been developed so as to be of exceedingly great value in war. How then does it happen that this development has not made the airplane of correspondingly great value in peace?

One minor reason is that the risk to the pilot, his passenger, and the machine is not a controlling factor in war use. Hence, war pilots, war airplanes, and war methods of operation were properly such as to leave the risk excessively high as compared with what is allowable in transportation in time of peace. On the fighting front of the Allies during the war, only two per cent of the aviation losses of life were caused by the enemy; eight per cent were due to failure of the airplanes, and about ninety per cent were due to trouble in the pilot himself, either physical troubles or errors of judgment.*

In war most of the peculiar value of an airplane arises from its use in transportation between an initial station on the ground and a terminal station in the air. In war the only rival of an airplane in this kind of transportation is a balloon, and its rivalry is very limited in scope. In peace, on the other hand, there are relatively few cases in which it is important to secure transportation for men or materials to a terminal station which is in the air. The great bulk of all passengers and commodities transported in time of peace are to be carried from an initial station on the ground to a terminal station also on the ground. This difference as to terminal stations accounts very largely for the great discrepancy between the extremely high value of airplanes in war and the large numbers required, and the relatively small peace value of the airplane and relatively very small numbers neded in peace.

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*Aeronautics in the United States at the Signing of the Armistice November 11, 1918, an address before the American Institute of Electrical Engineers by George Owen Squier, Ph.D. (January 10, 1919), published by the Institute, pages 33-35.

A bombing airplane delivers its load of bombs at a terminal station in the air, from which they fall freely to their objective on the ground. An airplane used in photographic work over a fighting front, or over the enemy's territory, delivers its camera at a terminal station in the air, a station of great advantage where sight is unobstructed and the risk from enemy fire is relatively small. An airplane used by an observer in securing information as to the enemy's actions is of great value because it carries said observer to a terminal station of advantage in the air. A combat airplane used to maintain supremacy in the air is indispensable because it delivers machine guns at a terminal station in the air within range of the enemy airplanes. There is no other means of putting guns at such a station. In all of these typical uses of airplanes in war the great value arises from the fact that the airplane plies between an initial station on the ground and a terminal station in the air, at which its load is delivered, or its passengers perform their function. In time of peace, in nearly all cases passengers and commodities require transportation between an initial station on the ground and a terminal station also on the ground. Hence in these cases, the airplane, if used, must compete with other carriers, the steamships, railroad trains, electric cars, or automobiles that may ply between two such stations. In such competition its relatively high over-all cost of operation will necessarily count heavily against it,—in commercial competition.

What are the few exceptional cases occurring in times of peace in which the passenger or other load is required to be delivered at a terminal station in the air? In such cases the airplane will be without a rival, except possibly some other form of aircraft, and will therefore find an immediate commercial possibility.

Much of the topographic surveying of the future will probably be done from aircraft by photography. Photographs which will bring out the detail needed in topographic maps may be made from an airplane at full speed a mile above the ground. The Bagley Camera, developed for such special use, takes three photographs at one push of the button, one looking directly downward, and one at each side at an angle of about 30 degrees looking downward. With this camera photographs covering a strip of three miles wide may be taken as fast as the airplane flies. Compare that speed in surveying,—a strip three miles wide at 90 miles per hour,—with the speed at which a topographic survey may be made with a plane table or transit, and it becomes evident that even though the photographic work may need to be supplemented by considerable work upon the ground, it will greatly increase the speed and reduce the cost of the topographic surveying. Topographic maps of a moderate degree of accuracy and abundant detail may be made mainly from the air with great rapidity now. Of course, to make a genuine map, rather than a mosaic of pictures, there must be control work by standard methods on the ground. Some work on the ground will also be needed in some kinds of country to supplement the air work where detail is obscured by trees, for example, and to supply some of the contours. Extensive improvements are necessary in the methods and instruments before the highest grade of topographic mapping may be done from the air,—the critical improvement being an instrument that will hold a vertical reference line in the air with sufficient accuracy. I am confident, however, that if the federal government would concentrate definitely on the development of the necessary instruments and methods for making the highest grade of topographic surveys largely from the air, that by 1922 it would be possible to make the highest grade of maps of the U. S. Geological Survey and Coast and Geodetic Survey largely from the air, including the location of contours, at a much higher speed and at a much lower cost than at present. There are vast areas in which such maps are urgently needed, and there is a correspondingly great opportunity here for airplanes.

A joint committee on aerial mapping with representatives from various government bureaus was organized in the summer of 1919. But to date the committee has busied itself with discussions of inter-bureau relations rather than the development of methods and instruments for aerial surveying, and so has made no appreciable progress toward developing aerial surveying.

Note that in making topographic surveys the advantage of the airplane arises from its ability to carry a camera and observer to a terminal station in the air.

Meteorological observations at high altitudes are needed to develop a better understanding of the air conditions far above the earth's surface, and possibly to aid in special weather predictions for the benefit of airplane operation. The fuel cost, and the time, for a given airplane trip may be greatly increased or reduced according to whether the airplane travels at the proper level to secure the most favorable air current or happens to hit the most unfavorable. It seems to the speaker that an ascension by airplane each day, 15,000 feet, from each of three points, say one on the Pacific Coast, one in the Mississippi Valley, and one on the Atlantic Coast, carrying meteorological instruments and an observer, is the minimum with which the United Staes government should be content. This is an ideal case of advantage for the airplane, where the requirement is that an observer and instruments should be taken to a terminal station high in the air.

A coast patrol of the Coast Guard Service will be at a decided advantage if he can be put into a commanding position in the air. Similarly the fire patrol of the Forest Reserve needs such a commanding position. I have been told that when the raising of cotton in certain parts of Texas was forbidden on account of the danger of importation of an insect enemy that an airplane was successfully used to detect forbidden cotton fields. Possibly airplanes may be valuable in securing statistics of the state of growing crops. These are all cases arising under peace conditions in which it is desirable to deliver an observer at a terminal station in the air, and in which the airplane therefore has an immediate opportunity.

The total of immediate commercial possibilities for airplanes is very small as compared with the opportunities now for railroad trains and steamships. Even if airplane use were immediately extended to all of the mail service where it is now commercially justified, if the airplane passenger service were developed at once to its full commercial possibilities, if airplanes were used in all our topographic surveys, if airplanes were fully utilized in the Weather Bureau, and if in all the other cases mentioned in which it is desirable for an observer to be high in the air in times of peace, airplanes were fully used,—if all these things were done, the total transportation by airplanes would still be very small as compared with that by railroad trains, by steamships, or by automobiles.

It is unquestionably important to extend these present limits of commercial possibility of use of airplanes and to develop the civil use of airplanes as far as possible within the new and wider limits. How may these things be done most effectively? If the cost of carrying by air can be reduced from 0.5c per pound-mile to 0.05c per pound-mile, and a corresponding improvement made in safety and reliability, the commercial possibilities will be greatly increased. The problem of extending the present limits of commercial possibility of the use of airplanes is exceedingly difficult and complicated. It is one to be solved by continuous, persistent effort rather than by shouting. It is one to be solved by facing the difficulties rather than by rhetoric. By continuous, persistent effort the civil use of airplanes may without doubt be greatly extended.

I submit that the following four things should be done. They are needed steps toward solving the problems that are now possible.

First, the present commercial possibilities should be fully utilized as promptly as possible, in mail service, in a millionaire and sport passenger service, in topographic surveys, and in transportation of aerial observers. With further extension of service there will come an increase of experience per year. From larger experience will come more rapid progress in improving methods of operation and in the adoption of improved standard equipment.

Second, the federal government should establish laws, and the proper agency for their enforcement, to define the navigation rules of the air and the conditions under which airplanes may be operated, just as the present laws fix the conditions of navigation by water, fix the rules of the road at sea, and provide for proper inspection of the equipment of vessels and the proper training of the men who operate them. Such laws in regard to air navigation, and their enforcement, would increase the safety, and promote the use, of airplanes. As the laws for water navigation are enforced by a bureau of the Department of Commerce, so the air navigation laws should be enforced by an appropriate bureau.

Third, landing fields for airplanes should be provided, equipped and maintained, at as many places as is feasible throughout the United States. The predominating risk in airplane operation, overshadowing all other risks, is that of forced landings. If the motor stops, and does not start again, when an airplane is a mile above the ground, the pilot must find a landing place within five miles and steer to it within five minutes,—and if he is only 1000 feet above the ground he must find the landing place within one mile and reach it within a minute or so. Obviously the risk of airplane navigation may be greatly reduced, and its reliability correspondingly increased, by a large increase in the number of available landing fields.

Fourth, and in the long run the most important thing to do is to speed up improvement in airplanes and their operation by scientific research, by design, and by invention.

So far as I know, the best statement to date as to the possibilities of the civil use of airplanes is a certain committee report to the British Parliament rendered early in 1918.* That report indicates that in the opinion of the committee the four lines of scientific research, of design and of invention that are most important in the immediate future are:

(1) The modification of airplanes to diminish landing speeds without limiting flying speeds.

(2) The development of directional wireless.

(3) The development of the turbine system applied to internal combustion engines.

(4) The development of the gyroscope and its incidental uses.

At present the higher is the normal flying speed of an airplane, the higher is the necessary landing speed. The result is that at present airplanes comparable in weight with heavy automobiles must land at high automobile speeds, 35 to 60 miles per hour, in fields (not roads) on which even a reckless chauffeur would slow an automobile down to 20 miles per hour. The dangers of landing are great. When airplanes are so built that the landing speed is under 30 miles per hour even though the flying speed is above 90 miles per hour, the landing danger and the necessary size of the landing field will be greatly reduced. Possibly the future airplane will increase its wing area when it is about to land; possibly it will change the shape of its wings; or possibly it will use some kind of a brake in the air just before landing.

The directional wireless is needed in a highly developed form to help in locating one's self in the air and in finding the landing place. If the birdman can see aerial lighthouses, can see his landing-point,—with a wireless eye,—he may keep on his best course and may hit his landing-place safely, even though he cannot see it with his own eyes until he is within a few feet of it.

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*Reports of the Civil Aerial Transport Committee with Appendices, presented to Parliament by Command of His Majesty, February 7, 1918.

April 5, 1920

I suppose that the English class the combustion turbine as extremely important because of the possibility of thereby securing extreme lightness and compactness for a given horsepower.

The ideal airplane engine would be without weight and would look like a mathematical point when seen from in front,—so that it might have but little head resistance.

The gyroscope is needed as a safety instrument to tell the aviator whether he is on an even keel when he cannot see the ground or water; as a navigation instrument to help the aviator to determine his position at sea, or over land when he cannot see the ground; possibly as a part of a stabilizing system in charge, in part, of the controls; and for other purposes.

These four lines of scientific research, design, and invention, have been used as illustrations of what is needed most urgently. I believe that these four lines as listed by the English are the most important to be followed in the immediate future provided the statement as to engine improvement be extended so as to include the development of the reciprocating internal combustion engine, its accessories (carburetor and cooling system especially), and its fuel.

To summarize,—the civil use of airplanes should be increased, and in the attempt to do so, four immediate steps should be taken.

(1) The present commercial possibilities should be utilized fully and thus increased experience secured. To the end of utilizing present possibilities fully, sensibly directed promotion is needed, promotion directed toward those peace applications of the airplane in which it now has an advantage,—surely not directed toward the carrying of freight or of ordinary express.

(2) The federal government should establish airplane navigation laws and the proper agency for their enforcement,—this in order to increase safety and promote the use of airplanes.

(3) Many widely distributed landing fields should be provided, equipped and maintained.

(4) Improvement in airplanes and their operation should be speeded up by well-directed scientific research, design and invention. Progress in scientific research, design and invention will accelerate and invigorate progress of other kinds. For example, such progress in these lines as would reduce the cost of airplane transportation to less than 0.05 cent per pound-mile would open up a vastly increased field for the use of airplanes. On the other hand, failure to make progress in scientific research, design and invention will after a few years inhibit progress in other lines.

It is safe to predict that if in the next twenty years much progress is made in scientific research, design and invention in connection with airplanes, then there will be a large increase in the civil use of airplanes. It is still safer to predict that if but little progress is made in scientific research, design and invention in the twenty years, 1920-40, there will be only a moderate increase in the civil use of airplanes in 1940 beyond that of 1925.

The civil use of aircraft should be developed to secure the direct benefits of that use.

Perhaps it is still more important to develop the civil use of aircraft in the United States in order to make it feasible for us promptly to build, organize and use a great and effective air fleet in the event of another war.

This paper has been an attempt to present a sane view and a constructive program for the civil use of airplanes.

CLOSURE.

Presented by John F. Hayford.

The Paris-London air service is still in operation but is probably no better than our Postoffice Service. Business men frequently use the service to expedite trips, but only to a fractional extent of the total travel, a fraction corresponding to the necessity of very fast time. There are accidents, unquestionably, but they get comparatively little attention, being taken for granted at the present time.

Accidents are far more frequent in our Army Service than in our Postal Service because it is still considered necessary in the Army to train men to do acrobatic stunts that require more risk. Information, that may be considered reliable concerning accidents in the Army Service, indicates that the number of fatal accidents was one per day in 1919. Combat between two planes is usually during a series of acrobatic stunts and the training for such combat therefore will involve training in the most hazardous character of flying.

Comparative costs per pound-mile for a 90-mile speed and a 150-mile speed can only be roughly approximated. Head resistance varies as the square of the speed. To increase speed by 50 per cent more than doubles the head resistance, with an increased cost not only due to the added resistance but due to the necessity for making a stronger, higher grade machine. The trend of present development suggests a speed of about 100 miles per hour. It is, however, impossible to make a close prediction for the future.

Is it fair to judge the commercial carrying possibilities of the airplane by the present costs as stated for the Postal Department, one-half cent per pound-mile? Should not greater capacity reduce costs?

The Postal Department already has larger machines for probable use between Chicago and New York, modified Martin Bombers, with two or three engines which will carry 1,000 to 1,500 pounds of mail. Costs for fuel, maintenance, operation and depreciation all go to make up the total cost and I am not willing to predict a cost per pound-mile in the regular service below one-tenth of a cent. The ariplane, as I stated before, "is in its infancy and the freight train is a mature giant." The half cent figure is one already attained. While it is true that fuel costs may be reduced in the way indicated yet the other costs are not reduced to anything like the same degree. Fuel costs were 7 cents per mile out of a total of 89 cents, during the first year of operation of the Washington-New York route.

It is within the range of engineering possibility to so construct a plane as to enable it to hover in the air. It could then land when its horizontal speed is zero. Early in the war the suggestion was made that the helicopter, a flying machine using a vertical propeller or propellor enabling it to fly straight up without horizontal translation, be developed for war use, but the military advice was that it would not be desirable for a war plane to stand still. Such a machine is feasible if an engine and propeller be developed capable of exerting a total lift as great as the weight of the machine and load. Its development will probably come if the demand is sufficient. Development along present lines might produce an engine and propeller of such power that it could head straight up and fly, without sacrifice of horizontal speed and such a machine would reduce the landing danger greatly. Its commercial possibilities, however, are probably not great.

One difference between the use of airplanes in war and their use in peace lies in the fact that cost in war time is largely immaterial if the desired result is attained. In peace times cost must be considered. This suggests that the cost of landing fields may bear heavily on total costs and therefore on further development of service. The cost of highways and waterways should be considered as part of the cost of highway and waterway transportation just as truly as the costs of tracks and permanent way are a part of railway transportation costs, regardless of present practice in that regard. The same will be true of the cost of landing fields which may be one of the large unit costs of transportation by airplane. That unit cost will, however, go down as the number of airplanes in the air goes up.

Governmental agencies and the various aero clubs are working to provide landing fields. Mr. Stevens, vice-president of the Aero Club of Illinois, stated that without fields the growth of merchant aeronautics is limited and that the government has prepared plans for fields of several sizes but has no funds for building them, leaving it to the cities to build, equip and maintain them. It has closed more than half of the 21 or 22 fields controlled during the war for training aviators. The number of planes, outside of those in postal service, is so small, however, as to make it difficult to get the fields in advance of the growth of the airplane. Mr. Stevens urged the development of landing fields as a national proposition in order to foster aeronautics not only as a commercial means of transportation but as a protection should there be another war. If we had landing fields one-half mile square every five miles between Chicago and New York, it was his belief that the coming of the commercial airplane would be at least ten times as fast as it is apt to be for the want of that one thing.

Should not the development of the airplane for military use parallel the development of battleships, submarines and machine guns? Why should the military need suggest the civil use of the airplane when the air services of the Army and Navy might continue to develop military planes in time of peace?

The best answer is that battleships, guns and airplanes are dependent upon a proper industrial development, capable in war time of turning immediately to building ships, guns and airplanes. We have that development necessary to produce ships and guns. A broad civil airplane program would prepare us to develop an air fleet quickly and efficiently in time of war. There is also the difficulty of getting adequate appropriations from Congress to keep up a large air fleet in times of peace by either the Army or Navy air services.

As to reliability of the Postal Service in keeping to schedule time I said that between Washington and New York, 93 per cent of the scheduled flights were made. Few of them were behind time. The direction and velocity of the wind are large factors in keeping to schedule, much more so than is true of direction and velocity of water in a lake or ocean in their influence upon the schedule of ships. Furthermore, a 90-mile an hour machine must maintain a speed of at least 60 miles per hour relative to the air in order to keep in the air safely. If engine trouble prevents that speed the pilot is likely to seek a chance to light. Therefore there were comparatively few trips that were successful and much behind time.

The Washington-New York service was proposed as a large scale experiment, although the short distance, 218 miles, was not favorable for a competitive test. The Postoffice Department had tried unsuccessfully to let contracts to carry mail in Alaska and determined, partly on the advice of our Advisory Committee, to make the first attempt where physical conditions were favorable to success and where the experiment could be conveniently watched. Yet the sale of airplane stamps, if I remember rightly at 16 cents per ounce originally, exceeded slightly the expense of operation for the first year.

The alleged slow Englishman has, in the matter of the commercial use of airplanes, started on the right track long before we have. So far as I know, the best document yet written on the civil use of airplanes was the British Report to Parliament written late in 1917. The English followed up that report by making a trial flight from London to Calcutta in January or February, 1919. The fact that the English are adopting a better course toward the successful development of the civil use of airplanes than we, has led me to prepare this paper and at every opportunity I am seeking to stir up Americans to realize that we can advantageously follow England's lead and that we must look at the facts and overcome the difficulties.

It has been suggested that the risk in flying under civil conditions is perhaps no greater than the risk of automobiling over a rough road and that the factor of safety for an airplane is comparable with that for a freight train or a railway bridge. That might possibly be true if it were not necessary for the airplane to make landings. The low factor of safety of the airplane does not discredit its design but only emphasizes the inherent difficulties in the problem, largely in the limitation of weight.

Another suggestion covered the training of pilots. We sought college trained men for the air service during the war and they were not of the type we might expect to continue flying as chauffeurs. No method has been used or proposed for training men who would continue in such service. The suggestion was that there be organized a reserve flying corps in each State subject to the call of the Government and equipped with the Government's surplus airplanes. Thus it might be possible to develop pilots who would be glad to follow the work as pilots for commercial machines.

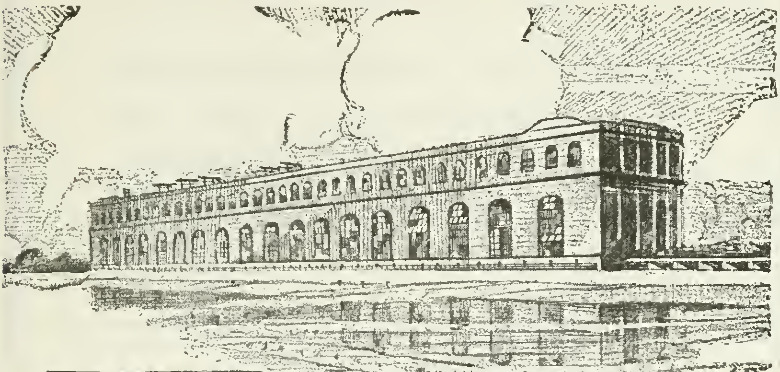
It is hardly possible that the airplane will develop as rapidly as the automobile has developed from the days of the horseless carriage. The automobile early reached a point where it became a commercial rival of existing methods of transportation between the same stations on the ground. With large resulting use came quick development in construction and operation.

The commercial possibilities of the airplane are limited and the engineering difficulties far greater than in the case of the automobile. An airplane engine with all accessories is not worth considering if its weight exceeds two pounds per horsepower. The Liberty Engine developed 400 plus horsepower and weighed 800 plus pounds.

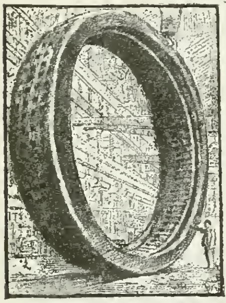
The automobile engine has no severe weight limitations. Nor is it often called upon for more than a few minutes at a time to operate at highest capacity, full speed and full load. If troubles develop the car may be stopped at once and the trouble remedied.

When an airplane engine stops and does not start again, a suitable landing place must be found within five minutes or five miles if the plane is one mile up or within one minute or one mile if the plane is 1,000 feet up. Otherwise a serious accident is certain. The reliability requirement for the airplane engine is much higher than for the automobile engine.

It is not safe therefore to reason by analogy as to the future development of the airplane.



Mississippi River Power Company, Keokuk, Iowa



A casting for one of the huge water-wheel driven generators installed in the Mississippi River Power Company's plant at Keokuk. This installation will ultimately consist of thirty of these machines, giving a total capacity of 216,000 kilowatts (300,000 horse-power). It is the largest hydro-electric development in the world. The General Electric Company builds generators for water-wheel drive in sizes ranging from 37½ to 32,500 kilowatts and the aggregate capacity of G-E units now in successful operation is in excess of four million horse-power.

Utilizing Nature's Power

ELECTRICAL energy generated by water power has grown to be one of our greatest natural resources—and we have only begun to reach its possibilities. It mines and refines our ores, turns the wheels of industry, drives our street cars and lights our cities and towns. The power obtained from Nature saves many million tons of coal every year.

At first the field of its utilization was limited by the distance electricity could be transported, But soon research and engineering skill pointed the way to larger and better electrical apparatus necessary for high-voltage transmission. Then ingenious devices were invented to insure protection against lightning, short-circuits, etc., which cause damage and interrupt the service. And now all over the country a network of wires begins to appear, carrying the magic power.

The General Electric Company, with its many years' experience, has played a great part in hydro-electric development. By successfully co-ordinating the inventive genius of the company and its engineering and manufacturing abilities, it has accomplished some of the greatest achievements in the production and application of electrical energy.

The old mill wheel of yesterday has gone. Today the forces of immense volumes of water are harnessed and sent miles away to supply the needs of industry and business and the comforts of the home.

General Electric Company

General Office
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HERBERT HOOVER was unable to attend the Joint Engineering Societies Dinner. The following telegram, so delayed in transmission, did not reach Chicago in time to be read at the dinner:

EDGAR S. NETHERCUT
SECRETARY
WESTERN SOCIETY OF ENGINEERS
CHICAGO, ILL.

DEEPLY REGRET I CANNOT BE WITH YOU TONIGHT. THE PROBLEMS BEFORE YOU ARE OF VITAL INTEREST TO THE WHOLE NATION AND I KNOW YOU WILL MEET THEM IN THE SPIRIT OF SERVICE WHICH HAS GAINED FOR ENGINEERS THE RESPECT OF THE WORLD. I WISH YOU EVERY SUCCESS.

HERBERT HOOVER

CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV APRIL 20, 1920 Number 8

CONFERENCE OF ENGINEERING SOCIETIES, APRIL 19-20

It is of importance to the national engineering societies and the local societies that relations concerning membership and activities be more firmly defined and adhered to.

In recognizance of this important feature, the Board of Directon of the Western Society of Engineers invited the governing boards of the four Founder Societies to hold contemporaneous meetings in Chicago—the engineering center of the Middle West.

Responding agreeably to this invitation, representatives of the four societies met here on April 19 and 20 and the American Society of Civil Engineers, the American Society of Mechanical Engineers and the American Institute of Mining and Metallurgical Engineers held meetings of their boards. The American Institute of Electrical Engineers were unable to arrange for a meeting because of previous plans that could not be altered.

Although the business of each of these societies was transacted separately, numerous conferences on matters pertaining to the report of the Joint Conference Committee were held.

At present leaders of the engineering profession are endeavoring to co-ordinate the activities of the national and local societies. They have at heart the hope of bringing about an effectual method of inter-organization of societies for the benefit of the country and the profession.

The Joint Conference Committee report has been approved by the boards of the Mining, Electrical and Mechanical engineers, but the Civils submitted the report to their membership in the form of a questionnaire, together with the recommendations of their development committee. Questions 1 and 2 of this ballot were approved by the membership at large, but question 3 was voted down. It was announced at the meeting here.

The three propositions were:

(1) Shall the American Society of Civil Engineers "adopt the principle of becoming an active national force in economic, industrial and civic affairs"?

(2) Shall the Society actively cooperate with other engineering and allied technical associations in promoting the welfare of the engineering profession?

(3) Shall the Society for the purposes set forth in (1) and (2) actively co-operate in the creation of the comprehensive organization as outlined in the Joint Conference Committee report?

On the basis of this advance ballot, it is apparent that A. S. C. E. members prefer to assume a safe position and do not desire to complicate the situation at this time by engaging in the new organization proposition, although various interpretations have been placed upon the results of the ballot.

The conference of technical societies, it was announced, will be held in Washington in the early part of June. A modification of the plan of the Joint Conference Committee will, in all probability, be presented at that time.

The Board of the Western Society appointed a Committee on Local Arrangements which arranged for the dinner April 19 and the luncheon on the 20th, besides securing hotel reservations for the visiting officers.

The members of this committee were: Albert Reichmann, W. D. Gerber, representing A. S. C. E.; George M. Davidson and F. G. Fabian, A. I. M. E.; A. L. Rice and G. R. Brandon, A. S. M. E.; A. F. Riggs and A. C. King, A. I. E. E.; and F. K. Copeland, A. B. Benedict and Edgar S. Nethercut, W. S. E.

ENGINEERING DINNER

The first "Joint Engineering Societies" dinner held in Chicago occurred on April 19 at the Hotel La Salle on the invitation of the Western Society of Engineers. There were about 350 members of the national societies, the Western Society and other Chicago engineering organizations and their ladies, present.

Dr. Theodore G. Soares, head of the department of Practical Theology and Professor of Homiletics and Religious Education, University of Chicago, was the principal speaker of the evening.

"There is the greatest need for the application of engineering principles to the life of the layman. A knowledge of engineering gives a training for leadership.

"The great misfortune of the world today," Dr. Soares continued, "is that we cannot find men big enough and capable enough to lead us. It is not a problem of finding large tasks to accomplish but rather a problem of finding a person with the qualifications of leadership for the solution of the hundreds of questions that come up every day and on which we are all vitally dependent.

"Ministers—I am one of their number—are engineers engaged in the creation of ideals in humans. We are all dependent, one on the other, in our daily life and intercourse, and so, it seems to me, engineering organizations must group together not only for advancement of the profession for which they stand but for more efficient service to the populace; service, surely, is the guiding word in this enlightened age in which we live."

Arthur P. Davis, president American Society of Civil Engineers and head of the U. S. Reclamation service, emphasized the importance of the question of federation, which lately has so occupied the attention of engineering societies.

"We must get together," he said, "much is expected of us. We have seen what co-operation between the Founder Societies has done. Would not the effect be even greater if all our societies could still retain their identities yet be federated under one national organization? The American Society of Civil Engineers, through a recent ballot, strongly endorsed such a proposal."

Because of the absence of Herbert Hoover, President A. I. M. E., Arthur Thatcher, a director of the A. I. M. E., represented the mining and metallurgical engineers.

Fred J. Miller, president American Society of Mechanical Engineers, formerly editor of American Machinist, and now a consulting mechanical engineer in New York City, emphasized the part that proper publicity can play in developing a technical society.

Calvert Townley, President American Institute of Electrical Engineers and assistant to the president of Westinghouse Company, declared that engineers have not learned the value of team work.

"Engineers have accomplished many wonderful achievements, by their individual efforts," he said. "They have not learned the value of pulling together."

Mme. Else Harthan Arendt presented two groups of songs and under the direction of the orchestra, community singing was indulged in.

JOINT LUNCHEON OF ENGINEERING SOCIETIES

National Societies and W. S. E. Hold Co-ordination Conference

The meeting was called to order at 1:45 p. m. by Edgar S. Nethercut, Secretary of the Western Society of Engineers, there being 73 present.

Mr. Nethercut said:

"In the absence of Mr. F. K. Copeland, President Western Society of Engineers, I wish to express his regreat at not being able to attend and participate in this meeting.

"The object of this notable occasion is of importance in the affairs of engineers in Chicago who are active and interested in engineering societies.

"The opportunity of this occasion is to so present the plans and progress of Chicago engineers so that jointly with the national engineering societies a simple and comprehensive relation can be established for the upbuilding of the profession and as a duty of citizenship.

"The invitation to attend this meeting has been extended to the visiting members of the governing boards of the four Founder Societies, the officers of the local sections of the Founder Societies, the Board of Direction of the Western Society of Engineers, past officers of the Founder Societies residing in Chicago and members of Engineering Council in Chicago.

"The local committee having no definite plans for this gathering except to present an opportunity for an interchange of views, has suggested that Mr. Calvert Townley, president of the American Institute of Electrical Engineers, preside.

"The invitation to hold jointly the meetings of the governing boards of the Founder Societies has resulted in meetings of three societies. The A. I. E. E. was not able to change previous plans. But because of the interest in this occasion Mr. Townley is with us to show the interest of his society in our affairs."

Mr. Townley, on assuming the chair, said: "The committee on local arrangements has requested Mr. Nethercut to present a statement of the organization methods of Chicago engineering societies at this time."

Mr. Nethercut's statement in full follows:

W. S. E. ACTIVITIES AND RELATION TO ORGANIZED PROFESSION.

"In the absence of Mr. F. K. Copeland, President Western Society of

Engineers, I have been asked by the Committee on Local Arrangements to briefly make a statement as to the methods of organization and activities of Chicago engineers as represented by the Western Society of Engineers. I will call attention to the effect of carrying out the provisions of the Joint Conference Committee's report upon the organization methods of engineers in Chicago. I believe this is important in any plan to create an organization country wide with a local society or association as the basis.

"This Society having an all inclusive and personal membership, and with a central location for Office, Lecture Room and Library, and an efficient service covering many years, can and does represent the profession in Chicago.

"This Society celebrated the fiftieth anniversary of its organization last year. It was organized in 1869 as the Civil Engineers Club of the Northwest, it being the third engineering society in America.

"The name and form of organization was changed in 1880 when it became the Western Society of Engineers. The change in name indicates the inclusion of the branches of engineering which were being recognized as distinct from civil engineering. The name also indicated a feeling that western engineers needed a society with headquarters in the central states. The requirements for admission are as high as those of any National Society.

"The progress of the Society was uniform and satisfactory for many years. Due to normal growth the membership doubled each ten years up to 1909. The statistics show that subsequent to 1909 the membership did not increase normally or in proportion to the increase in engineering population. During our extensive membership campaign last year, we received approximately as many applications for membership as during the previous fifty years.

"Activities of this Society have been largely technical, consisting of the presentation of papers, the publication of a Journal, and the maintenance of a library. This Society has, however, always had good fellowship among its members and attention to social intercourse has been prominent. The Society has always been free from division among its members. Any rivalry that has occurred has been courteous and friendly. The Society has always had the services of the leaders of the engineering profession in this vicinity on its Board of Direction and in the active committee work.

"The broadening view of Society affairs was evident a number of years ago, as is instanced by the remark of Mr. Octave Chanute, who in 1902 at the close of his presidency stated that in his judgment the Western Society of Engineers had never functioned properly. I have been unable to find any record of his suggestions as to the proper functioning of this Society, but his remark was a sufficient cause for study to determine, if possible, the proper procedure for a society of engineers having their headquarters in Chicago and a membership 60 per cent of whom were resident in this immediate vicinity.

"During the succeeding years considerable consideration has been given to this by our members in order to properly solve this problem. It is apparent that like effort has been made by the various organized societies throughout the country, not only local but national.

"Mr. Sidney Webb in his study of

professional societies has indicated three motives for organizations:

A—Scientific or creative instinct.

B—Fellowship or social instinct.

C—Material or possessive instinct.

There have been organized societies along each of these three lines; the national societies along scientific lines, the clubs along social lines, and recently unions having the material welfare in mind.

"A local society such as the Western Society of Engineers (for at the present time approximately five-sixths are residents of Chicago and suburbs) whose members have intimate contact with each other, and whose problems technical, social and civic are common, and who believe fundamentally that material progress must be founded upon technical achievement, has so planned as to combine all three reasons given by Mr. Webb as the basis of one organization. These are so interrelated and dependent upon each other that for the sake of uniform progress they may be properly combined with emphasis on the creative instinct.

"There was appointed by this Society last year a Committee on Development to co-ordinate a plan for the various proper activities. In the matter of membership it developed that a really small percentage of the engineering population of Chicago were members of our Society; likewise a really small percentage of the local members of the national societies were in our Society. The figures were as follows:

A. I. E. E.— 9 per cent
A. S. M. E.—10½ per cent
A. I. M. E.—12½ per cent
A. S. C. E.—36½ per cent

"It is also developed that social relations could be well advanced by the alignment of the membership on non-technical lines for the proper consideration of our civic relations where engineers of experience could assist in the proper solution of our local problems and discharge an important civic duty. It was felt that such activities would greatly assist in the estimate which we would place on ourselves, and also raise the estimate of the engineer in the eye of the public. Material welfare of the engineer would be advanced by the broadening of his technical knowledge, forming acquaintances, providing for social intercourse by these activities in the interests of the public.

"Without attempting to change the basic form of our organization, or even change the name of our Society, there has been developed an organization along the lines recommended by our Development Committee. The all inclusive character has proven sound. At the inception of our membership campaign last fall the question before the engineers of Chicago was should we have and do we believe in an all inclusive society with actual membership, the alternative being to organize on the federation plan. The success of our membership campaign was a complete and positive answer that the opinion of the Chicago engineers was in favor of the plan of the Western Society.

"It is estimated that there are at least six thousand technical men connected with the profession in Chicago. At the present time about 50 pe cent are included in our membership. The percentage of members of national societies in Chicago who are members of the Western Society is now approximately 50 per cent. We believe that it is proper to expect that this may be increased to more nearly 100 per cent when the principle laid down by Mr. Calvin W. Rice and other leaders in society activities, that "an engineer should first become a member of his local society and later join the national society of his specialty," will be thoroughly appreciated and acted upon.

"In this connection I wish to call attention to a service that the local society can render to the national society by emphasizing the value of membership in the national society, it being always understood that a man's professional standing is registered by his membership in a national society. In order to assist we carry at our office application blanks for the use of those who are interested in joining the national societies. An analysis of our membership roll indicates a surprisingly large numbe of engineers who are well qualified for membership in a national society, but who have evidently not given this matter proper consideration.

"Included in our membership are a considerable number who are just entering the profession. As they progress the effort will be to have them join the national society of their specialty. We also have members who have postponed membership in a national society so long that they will not consider it now.

"Our Board of Direction consists of the officers elected by the society at large; also the chairmen of each of the technical sections who are elected by the sections. As far as possible the chairmen and executive committee of each section are identical with the executive committee of the local section of the national society.

"The real active work of the Society is carried on by our regular committees of over two hundred of our members. In very few instances are any assigned to more than one committee. These committees can be grouped along five classes:

A—Administrative.
B—Technical sections.
C—Departmental.
D—Welfare.
E—Applied technical.

"The Administrative Committees are Finance, Membership, Amendments, Permanent Quarters, Affiliation, Development, Student Branches, Increase of Membership. The duties of each is sufficiently indicated by the name.

"The Technical Sections now organized are Electrical, Bridge and Structural, Hydraulic, Sanitary and Municipal, Mechanical, Gas and Railway. The sections that have been authorized and are now in process of organization are: Telephone and Telegraph, Industrial and Chemical. Each technical section holds its stated meetings. Over fifty meetings are scheduled for each year. These are generally held on Monday evening and convene at 7 o'clock. The first Monday evening of each month is designated as a general meeting of the Society, at which time the subjects covered are on the broader engineering matters. The executive committee of each section is in charge of its program. Our technical meetings are often held jointly with the Chicago sections of the national societies. This has proven very satisfactory and was originated by our Electrical Section jointly with the Chicago Section A. I. E. E. As fast as possible this is being extended to the other branches of engineering.

"The Departmental Committees are Library, Program and Publication. On the Program Committee are the chairmen of each technical section, and on the Publication Committee are the vice-chairmen of each technical section.

"Welfare. Before describing the Welfare Committees this work should be defined. There seem to be two ideas with regard to this.

"By some it is considered to include

that work of technical societies which tends directly towards the personal advancement of the engineers in material things. The other idea is that it is such work as engineers combined in a society can do which has as its first aim service to the community and which we recognize will in the end be most successful in promoting the interests of the profession. The Western Society is placing its emphasis on the second interpretation.

"The Welfare Committees (this term being used in absence of a better and more descriptive term) are Public Affairs, Entertainment, Excursion, Reception, Military, Noonday Luncheon, Speakers' Bureau, Licensing and Registration, and a Committee on Military Affairs. Included in this group is a Young Men's Forum, which provides an opportunity for informal discussion among our younger members of the particular problems of their professional advancement. The Public Affairs Committee is sub-divided as follows: Constitutional Convention, City Zoning, Highways, Engineering Employment and Smoke Abatement.

"The applied technical committees consist of the following: Terminals —rail and water—Inland Waterways, Aviation, Fire Prevention and Protection, National Department of Public Works, Engineering and Experiment Research at the University of Illinois, and Materials and Methods. The applied technical committees enable a regrouping of our membership so as to bring together men from the various technical branches who are interested in common problems. The grouping of our Welfare Committees is likewise irrespective of technical specialties, and this regrouping itself greatly increases the acquaintance and friendly relations among our members.

"Through these various committees and the activities of the same the Western Society of Engineers is now recognized as a civic body, and we are acting jointly with other civic bodies in Chicago, such as the Bureau of Public Efficiency, the City Club, the Union League Club, and the Association of Commerce. Jointly with the Association of Commerce, we have a committee who are making a study of the city water supply.

"The relation with the national society has always been maintained as closely as possible, and no thought has been given to the possible interference with the activities of the national society. A consolidation of effort by joint meetings has proved entirely satisfactory and the loyal support of the active members of the local sections of national societies has contributed very largely to our present activities.

"The Western Society in recognition of its position and desire to be of greater service to the National Societies is preparing to offer to the local sections clerical services and central permanent headquarters to care for the correspondence and activities of the section under the supervision of the Local Secretaries.

"During the war there was organized in Chicago a War Committee of Technical Societies. This committee consisted of representatives of nineteen societies, including the Chicago sections of national societies. It proved during the war very efficient and effectual in unifying our work. At the close of the war it was felt advisable to continue this committee, and the name was changed to the General Committee of the Technical Societies of Chicago. Through this committee co-operative effort is readily cared for. The co-ordination, however, of the profession in Chicago will undoubtedly be best affected by personal membership in the local society.

"Engineering Societies, local and national, have each a responsibility for the proper recognition of the profession and the advancement of its membership.

"There exists at the present time, in addition to the national organizations, a considerable number of local groups with various forms of organization. In order to correlate the activities of all of these societies, or associations of local societies, and in order that the proper functioning of each can be established, a simple and direct interrelation is being considered at this time.

"As a foundation for this the local society, all inclusive in its scope of membership, with close personal relationship, and direct contact of the members with each other and with the direct and definite local problem, should be considered. The national technical society, which gives the stamp of professional standing upon its members, can lead in the advancement of technical attainment with a direct relation with each local Society through its Local Sections. The government of the local Society should be usually in the hands of those who are responsible for the government of the local section of the national societies.

"A simple and direct relation should be established between the locals in the various parts of the country, providing for an interchange of membership and a ready means of communication and exchange of information. It can suggest facilities that will tend to inspire and unify the activities of the locals.

"Inasmuch as the welfare problems are to a large extent personal and local, the machinery for establishing this interrelation can be kept at a minimum and amplified as experience would indicate. This is for the sake of economy and in order to effectually promote the professional advancement and civic welfare.

"The recommendations of the Joint Conference Committee's report provides for local association of engineering societies in each locality as a basis of the organization of a nation wide association, and while it permits a local society, such as the Western Society, to form a center of grouping, it seems to overlook the fact that in a city like Chicago this might have the effect of divorcing considerable support from the local society. It also overlooks the fact that in many of the smaller communities where national societies are represented by a comparatively small number of men, it would be quite impossible to organize along the affiliation plans successfully unless it be with the central idea of a social club. The advancement of the profession has always been best promoted by emphasis upon the technical advancement, the social and material things are secondary but important, for this reason we recommend the consideration of the local technical society as a basis."

Mr. Townley called on Mr. E. S. Carman, member of the American Society of Mechanical Engineers and a member of the Joint Conference Committee, to present the activities of that committee.

"I think that we may sum up the aims of the activities of the Joint Conference Committee of the four National Engineering Societies in the word 'service,'" declared Mr. Carman. "In the last few years technical societies, both national and local in character, have considered technical problems only. All of these societies have done good work, but at the present time there is a larger field which they must occupy.

"To attain any definite end we must have a vision. The engineer always works with a vision. In the past he has had a vision of skyscrapers, railroads and tunnels; in the future he must have in addition to that a vision of 'service to mankind.'

"There have been several attempts made to organize an engineering federation. In 1916 Engineering Council was organized as a result of the demand of the profession for more complete co-operation between engineering societies. However, Engineering Council did not seem to meet the desire of engineers, although it has done, and is doing, a great work and deserves the compliments of this body of men. The four Founder Societies were responsible for this organization, but in 1918 there came a demand for an organization that would include more than the Founder Societies—in fact, every engineering organization in the country should be included in this organization.

"As you all know, a committee was appointed to study this question and a report was made which has been considered by the Boards of Direction and the membership of the National Societies by this time.

"Before this super-engineering society or federation can accomplish much, 'the spirit to organize' must be produced. There must be confidence and there must be co-operation, for co-operation is simply a synonym of confidence. Our societies must have confidence in each other. It is only this that will accomplish real public service. If we only organize for the engineers our vision will fail. We must co-operate not politically but as engineers.

"There has been, and I believe still is, some misunderstanding as to the meaning of the word 'Founders.' Its use has been so universal during the last year that it has become obnoxious to a large number of members of national societies. Let us call them 'National' societies in place of 'Founder' societies.

"This new organization of engineering societies is to be composed of delegates from every engineering Society in the United States that can qualify its members as engineers. We will be glad to take in the architects and those of the allied professions who are intimately connected with engineering work? We will then have anywhere from one to four hundred thousand engineers back of our organization.

"The delegates from these societies will elect a national council which is to be limited to thirty members. This council will choose officers from its members and meet once a month at some designated point.

"It is not the purpose of the organization to take up work that engineering societies have already done, but rather to interest themselves in matters referring to public welfare.

"The public today is looking to the engineer and the engineering profession for discussion and decisions on questions pertaining to civil government. More and more they are removing the yoke of the politician and looking to the technically trained man for guidance.

"We have an inheritance that has come down to us from our forefathers in the engineering profession. We must not lose this inheritance but we must make good this vision which we have and which we believe is near fulfillment.

"I believe that the time is not far distant when the invitation extended by Mr. Nethercut to have local offices of the national societies in an engineering building in Chicago will be accepted. Let us all put our hands and shoulders to the wheel and push along so that this vision may be fulfilled."

Mr. Arthur P. Davis, President American Society of Civil Engineers, was the next speaker.

"History has been made this morning," said Mr. Davis. "The Board of Direction of the American Society of Civil Engineers met in an informal conference with the Boards of Direction of the other national societies for discussion of this enlarged engineering federation. After this discussion the Board of the A. S. C. E. passed resolutions which are as near in keeping with the wishes of the membership expressed in their recent ballot as is possible.

"I believe that the Washington Conference will form a constitution that the American Society of Civil Engineers can adopt."

Col. A. S. Dwight, a director of the American Institute of Mining and Metallurgical Engineers declared that his organization would co-operate fully with the other national societies in making the plan of organization of the proposed federation effective.

Mr. F. F. Fowle, a manager of the A. I. E. E., expressed the hope that the Washington Conference would convene immediately and that a plan of organization might be worked out that would be acceptable to all engineering societies in general.

Dean J. R. Allen, Vice-President American Society of Mechanical Engineers, said that "there is a demand in the United States for a united engineering society, and this has been shown by the results accomplished by the joint engineering board in Minnesota which was organized to defeat unwise legislation in that state. If engineering societies can go to the legislative branches of our government collectively instead of as individuals they will accomplish much more."

The meeting was adjourned at 3 p. m.

Those present were:

John R. Allen, Pittsburgh.
John W. Alvord, Chicago.
Bion J. Arnold, Chicago.
Onward Bates, Chicago.
Willard Beahan, Cleveland.
C. A. Booth, Buffalo.
G. R. Brandon, Chicago.
William E. Bullock, Cleveland.
C. B. Burdick, Chicago.
H. J. Burt, Chicago.
H. L. Caldwell, Chicago.
E. S. Carman, New York.
G. H. Clevenger, New York.
H. S. Crocker, New York.
Robert A. Cummings, Pittsburgh.
Fayette S. Curtiss, Boston.
G. M. Davidson, Chicago.
Arthur P. Davis, Washington, D. C.
A. W. Dilling, Chicago.
Arthur S. Dwight, New York.
C. C. Elwell, New Haven, Conn.
F. G. Fabian, Chicago.
R. H. Fernald, Philadelphia.
E. C. Fisher, Saginaw, Mich.
Edwin J. Fort, Niagara Falls, N. Y.
F. F. Fowle, Chicago.
Gordon Fox, Chicago.
W. D. Gerber, Chicago.
C. E. Grunsky, San Francisco.
Ernest Hartford, New York.
John C. Hoyt, Washington, D. C.
C. W. Hudson, New York.
A. M. Hunt, New York.
Robert W. Hunt, Chicago.
C. A. Keller, Chicago.
M. S. Ketchum, Philadelphia.
Dexter S. Kimball, Ithaca, N. Y.
A. C. King, Chicago.
F. R. Low, New York City.
J. W. Lowell, Chicago.
C. F. Loweth, Chicago.
Charles D. Marx, Stanford University, Cal.

Leonard Metcalf, Boston.
Fred J. Miller, New York.
Edgar S. Nethercut, Chicago.
H. W. Nichols, Chicago.
J. A. O'Connor, Albany, N. Y.
George A. Orrok, New York.
S. H. Pegram, New York.
Isham Randolph, Chicago.
Albert Reichmann, Chicago.
Calvin W. Rice, New York.
C. R. Richards, Urbana, Ill.
A. F. Riggs, Chicago.
H. R. Safford, Chicago.
Earl F. Scott, Atlanta, Ga.
Albert Smith, Lafayette, Ind.
Bradley Stoughton, New York.
Charles L. Strobel, Chicago.
L. E. Strothman, Milwaukee.
F. L. Stuart, New York.
A. N. Talbot, Urbana, Ill.
A. D. Terrell, Chicago.
Arthur Thatcher, St. Louis.
George W. Tillson, Chicago.
Calvert Townley, New York.
Arthur S. Tuttle, New York.
Samuel T. Wagner, Philadelphia.
Edward E. Wall, St. Louis.
Linn White, Chicago.
Horace V. Winchell, Minneapolis.

BOARD OF DIRECITON

Steps are being taken to organize a Chemical Engineering Section of the Western Society, it was reported at the meeting of the Board of Direction March 25.

The lantern used for showing slides and motion pictures at meetings of the Society is to be equipped with an incandescent lamp instead of the present arc light. This will result in better service and a saving to the Society.

The Secretary was instructed to advise city authorities of the report of the Materials and Methods Committee recommending changes in the building code of the city with reference to timber stresses and classifications of structural timber. This report has been approved by the Board.

Receipt of the proposed plan for improving the water system of Chicago from City Engineer P. S. Combs, was reported.

EDGAR S. NETHERCUT, *Secretary.*

MECHANICAL SECTION

Prof. Bruce W. Benedict, head of the Shop Laboratories, University of Illinois, appeared before the Mechanical Section, W. S. E., and the Chicago Section, A. S. M. E., April 15. His subject was "Teaching Shop Executives."

The university is attempting to work out a plan of co-operation with industrial concerns whereby students in engineering will secure practical training in their profession during vacation. It is hoped that later on it will be possible to make this part of the course compulsory. Employers have an opportunity to secure young men for summer work to meet their needs and at the same time assist the university, he said.

The course in shop management, Prof. Benedict explained, is so designed that the leaders of natural ability are given the opportunity to develop their executive powers in plant and shop management. The students are the operating force of the shop laboratory, with the faculty acting as advisors. Contracts for material are taken and carried out, the products being sold to a number of local concerns.

The Lord Engineering Company, consulting engineers and structural designers in reinforced concrete, have moved their headquarters to 37 S. Wabash Ave., Chicago, 10th floor Powers Bldg.

JOURNAL
OF THE
WESTERN SOCIETY
OF
ENGINEERS

"To promote and advance the science and art of engineering."

TO YOUNG ENGINEERS

The day is not far distant when engineering students will be required to go to school twelve months a year —nine months in the engineering school and three months in the school of "practical experience."

Such a practice is in vogue in several leading engineering schools and technical educators are giving more mature consideration to the problem each year. Some schools attempt to aid the students in finding suitable situations during the vacation period.

The engineering student derives two distinct benefits from summer employment. First, he provides himself with a fund of practical knowledge of his special branch of engineering that proves invaluable as his course nears completion. Second, the wherewithal for his maintenance during the coming year is provided. "Going to school" costs money during these days of high costs.

There are other engineers who have passed through the preliminary stages of practical training and desire to attain a position of more responsibility, and influence. They have proven their ability, and perhaps, because their organization does not offer the opportunities for advancement desired, they are looking for more worlds to conquer.

Securing a position is not as easy as it seems to be, unless the applicant has available information to guide him correctly. Therefore, it is felt, that the establishment by the Western Society of Engineers of a special service for engineers seeking employment, will be of direct benefit not only to the applicant but to the employer.

The forwarding of a statement of education, experience, kind of work and location desired, and remuneration expected, will place your application on our files so that we may put you in touch with a position of your choice, if such is available.

Our services are at your disposal! Write us!

TO EMPLOYERS OF ENGINEERS

Based on the number of inquiries received at the Western Society for engineers during the last month, indications are that engineering work will go forward at an unprecedented rate during the summer and early fall months. Consequently, a greater number of engineers and engineering assistants will be required than ever before.

The great problem facing the employer of engineers is to find capable men for the positions which he has vacant. It is much easier to secure the needed men through an organization equipped to carry on such work than it is for the employer to go out on a still hunt himself.

June 1, or thereabouts, hundreds of engineering students will be released from our engineering institutions, some having completed their courses and others to be out until the fall term commences.

In this great body of men, the employer can easily and satisfactorily find men who meet his requirements.

In addition to these students, there are always engineers—experienced more or less—who are seeking a change.

The Western Society, in order to facilitate this bringing together of employer and prospective employee, is establishing a special service in its employment department. Employers are requested and urged to send in requisitions for men, specifying the kind of man wanted, the work to be done, locality, special features and salary offered. These requisitions will be filled as nearly as possible from the lists of available men.

Thus a distinct service both for the engineer and the applicant, with particular reference to the student, will be performed. Some engineers may hesitate at the thought of employing inexperienced men, but we all had to get our start. The student, with proper supervision, may soon qualify to do work of semi-importance, thereby releasing the more experienced men for work of more mature responsibility.

Our service is at your disposal! Write us!

PROGRESS OF PUBLIC WORKS CAMPAIGN

By M. O. Leighton

The latest, most significant and encouraging development of our campaign for a national Department of Public Works is the introduction into Congress of what is known as the "Smoot-Reavis Joint Resolution" (S. J. Res. 191) providing for a joint committee to consist of three members of each branch of Congress to make a survey of the administrative services of the government to determine what redistribution of activities should be made among the several services, and what departmental regrouping of services should be made, so that each executive department shall embrace only services having close relation with each other; and to prepare and submit bills and resolutions having for their purpose the co-ordination of the government functions and their most efficient and economical conduct.

This resolution is the direct result of our campaign. The Washington office participated in its preparation and is urging its immediate adoption.

The response of the country to our educational campaign for the co-ordination of the public works functions has been so persuasive that the members of both houses of Congress have appreciated the logic of the proposal. Almost the only questions remaining for consideration are those with respect to details. Inasmuch as the organization defects that have been pointed out in the public works field are, in principle at least, duplicated in all other lines of government activity it has been logically held by members of congress that reform in public works administration is but the beginning of a thorough reorganization, and that special legislative machinery should be set up by means of which the whole problem may eventually be solved.

It is not the intention of those most active in the furtherance of the joint resolution to delay consideration of the public works measure. It is generally recognized that reorganization of federal administrative functions must be achieved by successive steps and it is the intention that the joint committee of congress shall take up and dispose of the public works functions first.

As soon as a sufficient supply of the printed copies of the new joint resolution can be procured they will be distributed by the Washington Office of the Association.

Another encouraging feature in our campaign is the prospect that at least one of the political parties will incorporate the public works proposal in its campaign platform. We are unable to make a positive announcement concerning this matter because a final decision will not be made until the date of the national convention, but we are permitted to state that the present prospect is as favorable as it could possibly be at this date. The merits of this proposal should be presented to local delegates to the several national conventions by the supporters of this movement.

NEW MEMBERS

The following were elected to the grade of membership indicated, April 12:

1270 Munk, Wm. L., 931 Monadnock Block. Member.
1273 Levy, C. J., 1559 Sheffield Ave. Member.
1279 Henseler, W. R., 2216 W. 23rd Place. Jr.
1280 Peppendorf, O. Wm., 3239 Fulton St. Assoc.
1288 Rowe, James, 6626 University Ave. Assoc.
1392 Benjamin, H. A., 105 S. LaSalle St. Member.
1404 Shelley, E. F., 700 N. Central Ave. Member.
1405 Starr, Willard, 632 S. Lombard Ave., Oak Park, Ill. Member.
1410 Erikson, Mauritz L., 1131 N. Laramie Ave. Member.
1446 Sullivan, Wm., 3014 Osgood St. Member.
1451 Schlifler, B. C., 709 Chamber of Commerce. Affl.
1471 Straff, A. P., 6560 Winthrop Ave. Member.
1476 Emerson, H. L., 133 W. Washington St. Member.
1544 Bessey, Carl A., care H. M. Byllesby & Co., 208 S. LaSalle St. Member.
1566 Leighty, Wm. J., 333 Railway Exchange Bldg. Member.
1573 Eastman, Thomas F., 4920 Glenwood Ave. Member.
1584 Richter, Henry, 626 Highland Ave., Oak Park, Ill. Member.
1594 Adam, M. F., 1056 Monadnock Block. Assoc.
1618 Chalfant, C. S., 914, 910 Michigan Ave. Member.
1629 Anderson, Desse, 937 Newport Ave. Assoc.
1630 Crain, Arthur M., 1250 Monadnock Block. Member.
1632 Dvorak, Francis John, 1411 W. 18th St. Assoc.
1633 Miller, Henry R., care American Bridge Co., 40th St. and Princeton. Assoc.
1634 Root, Oza L., 7114 Blackstone Ave. Assoc.
1639 Des Isles, L. H., 542 S. Dearborn St. Member.
1776 Logan, Roy Charles, 3954 Michigan Ave. Jr.
1725 Popham, A. J., Room 725, 208 S. La Salle St. Assoc.
1726 Eggert, Geo. F., 825 Drexel Sq. Assoc.
1728 Gath, Andrew L., 234 W. 15th Place, Chicago Heights, Ill. Member.
1733 Jacobson, Max, 1245 S. Troy St. Affl.
1784 Kenstant, Nicholas L., 162 E. Pearson St. Assoc.
1787 Prilik, Charles Raphael, American Bridge Co., Gary, Ind. Assoc.
1820 Barnard, Harry, 1763 McCormick Bldg. Member.
1906 Lawson, Geo. E., 2438 Kimball Ave. Member.
1914 McHugh, C. G., Astoria, Ill. Member.
1921 Lippert, Rudolph E., 2315 Commonwealth Ave. Assoc.
1926 Christensen, Andrew, 1540 N. Homan Ave. Assoc.
1927 Quinn, Harry M., 1321 Waveland Ave. Assoc.
1940 Schoonmaker, Charles F., care Quaker Oats Co., Railway Exchange Bldg. Assoc.
1946 Dunderdale, George, 1347 Peoples Gas Bldg. Member.
1951 Wood, Mason B., 1112, 134 S. La Salle St. Member.
1955 Lungren, Edgar E., 11 Plum St., Aurora, Ill. Assoc.
1988 Flynn, Edward J., 2534 E. 106th St. Assoc.
2020 DuBois, Alexander D., 560 W. Monroe St., care Beaver Electrical Constr. Co. Member.
2028 Keeber, C. Hamilton, Riverside, Ill. Member.

2045 Borge, Kristian, 1331, 208 S. La Salle St. Assoc.
2054 Parkee, John C., 4719 Kenmore Ave. Member.
2070 Kavanagh, Thos., 3315 Lexington St. Assoc.
608 Armstrong, W. Scott, 140 S. Dearborn St. Member.
1393 Welter, Edward J., 208 S. La-Salle St. Assoc.

OIL AND GAS POSSIBILITIES IN MONROE COUNTY, ILL.

Recent work by members of the Illinois State Geological Survey in the neighborhood of Waterloo, Monroe County, has brought to light the presence of geologic conditions in that area which are favorable to the accumulation of oil and gas.

Detailed studies of the surface geology show that the rocks in this vinicity have been thrown into a series of low folds trending somewhat west of north and east of south. The most fully developed of these folds is an anticline extending from near Columbia to a little south of Waterloo. Indications point to the existence of a fault bounding the upfold on the west, following roughly the M. & O. Railroad.

On account of these structural features of the Waterloo fold, it is recommended that drilling tests be restricted for the present to a belt

*Appoximate Geologic Column for the Waterloo District**

	Name	*Thickness Feet*	*Description*
	St. Louis	200±	Limestone, dense, compact, hard and brittle, splintery fracture. Contains little chert. Is not readily distinguishable from the underlying Salem formation.
	Salem	100±	Limestone, gray to white, with a yellow tint in places. Notable for the absence of chert. Oolitic texture in part; partly made up of massed fragmentary fossils. May include some buff or drab dolomitic beds.
	Warsaw	75±	Limestones and shales intercalated. Outcrops usually show mainly limestone phase, the softer shale being concealed beneath talus or wash. *Spirifer* abundant in one stratum near top of formation.
	Keokuk—Burlington	125±	Limestone, white and pure, but with abundant chert bands irregularly sandwiched between the limestone strata. Commonly represented in outcrops by a cherty red clay which remains after the solution of the limestone. Lowest formation exposed in this locality.
	Fern Glen	40±	Limestone, prominently red and cherty.
	Devonian	40±	Limestone, gray; drill cuttings often cream-colored.
	Maquoketa	100±	Shale, dark gray, slightly calcareous.
"Trenton"	Kimmswick	50±	Limestone, like the Devonian in color, but usually granular. May show oil.
	Plattin	200±	Limestone, brownish-gray, granular. Most likely oil horizon.

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* In using the above table it should be borne in mind that the thicknesses given are merely the closest approximations now available, and that variations of considerable importance may be revealed as development proceeds.

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lying along and just east of the axis. By this restriction the Survey does not mean to imply that oil is certainly present within this zone or that oil may not be found outside of it. In the present state of knowledge, however, this belt appears the most favorable for careful testing.

The Kimmswick-Plattin, which is the equivalent of the so-called "Trenton" of Clark County, is the only horizon in this vicinity as yet proven to contain oil. The "Hoing" sand horizon of northwestern Illinois, which lies at the top of the Maquoketa, may or may not be represented here. It might be noted that the limestones above the Fern Glen include the horizons of the "Westfield" and "Mississippi" limes of eastern Illinois; however, lack of cover for these formations on the structure minimizes the chance of their producing oil.

The depth to be drilled is dependent upon two variable factors—the thickness of the strata and the location of the drill with reference to the structure and to the topography. The distinguishing marks of the various formations are as follows: the Salem limestone shows practically no chert; the Warsaw may have shaly bands all through the formation; the Keokuk-Burlington limestone has abundant cherty bands; the Fern Glen, marking the base of the Mississippian strata, is easily recognized by its red color; the Maquoketa is a dark-gray shale which may be as much as 100 feet thick; the Kimmswick is generally light gray; and the Plattin is brownish gray.

The finding of oil in a water well bears out the conclusions previously reached by geologists of the Survey that this is an area worthy of scientific testing.

One of the three wells in this vicinity, of depth sufficient to reach the Plattin, has failed to show the presence of oil. This is the water well drilled at the brewery in Waterloo, but in this case the absence of any log for the hole, together with its location somewhat off the structure, renders its negative evidence inconclusive. In this connection it is of interest to note that a show of oil was found in the Hergenroeder well, about two miles east of Waterloo, in what is probably the Kimmswick formation.

The Survey is ready to co-operate with those doing development work in the area, and it will be to the advantage of all concerned to have logs of all holes drilled sent in to the Illinois State Geological Survey, Urbana. Logs are especially valuable if they are accompanied by detailed samples, and sample sacks will be sent to those signifying their willingness to co-operate to this extent.

NEW APPLICATIONS

The following applications for membership were presented to the Board of Direction, April 12:

74 David Oliphant Haynes, Jr., Chicago.
75 E. E. Burroughs, Flint, Mich.
76 Joseph V. Sullivan, Chicago.
77 J. G. Reid (A. S. M. E.), Chicago.
78 E. Schwitkes, Chicago.
79 Frank J. Jakoubek, Chicago.
80 Frederick Arthur Loeb, Orland, Ill. (Transfer from Student).

The Spring meeting of the American Society of Mechanical Engineers will be held in St. Louis, May 24 to 27. One session of the meeting will be devoted to the development of transportation on the Mississippi River and another to the recent development in industrial housing in which there is a large project under way at St. Louis.

EMPLOYMENT SERVICE

NO CHARGE is made for opportunities announced in this section of the Journal.

ANNOUNCEMENTS must not be more than sixty-five words in length and will not be inserted more than twice during a period of two months, during which time all records will remain in the active files. All correspondence will be treated confidentially.

APPLICANTS for situations, not members of the W. S. E., must have card of introduction from a member of the Society.

ALL REPLIES should be addressed to the key number indicated, in care of Employment Bureau, Western Society of Engineers, 1735 *Monadnock Block, Chicago.*

SITUATIONS WANTED

B-450: BUILDING STRUCTURAL Engineer, Illinois State license. Civil graduate. 30; family; American. 4 years' clerical work; 7 years' engineering, concrete, steel and timber design; industrial buildings; warehouses; railway engine terminal layouts and buildings. Last 1¾ years in charge of squad. Some experience in bridge work. Salary $3,600 in engineering or allied work. Arrange interview.

B-451: ELECTRICAL ENGINEER with large manufacturer of electrical freight and passenger elevators desires a position as sales engineer. Have had excellent engineering education and broad practical experience with railway signals, remote electric control, industrial application of A. C. and D. C. motors and controllers and expert knowledge of electric elevator problems. Age 31. Excellent references.

B-452: YOUNG MAN, 23, WANTS work on construction projects, surveying, bridges, etc., out of town if possible. Have no experience. Attending school next term.

B-453: GRADUATE C. E. 11 years' experience heavy masonry and steel construction, railways, power plants. One year chief engineer oil company in Mexico. Want Chicago connection as sales or resident engineer, superintendent or estimator. Min. salary, $300.

B-454: GRADUATE C. E. AGE 28. Single. 2½ years' experience in bridge dept. of western railroad and at present employed by bridge company; will consider offer where his experience will be of value.

B-455: POSITION WANTED IN Middle West, preferably with some architect or building surveyor of repute, as sanitary engineer competent to supervise building erection from start to finish and also to take charge of drafting room. American, 40, have had foreign experience in sanitation; references. Former Assoc. Member A. S. C. E.

B-456: GRADUATE C. E. WITHout building construction experience, wants opportunity to start in outside building work. 6 months' experience with cost keeping systems; 3 months on heavy construction.

B-457: YOUNG GRAD. MECH. eng.; agreeable personality, initiative and sales ability is seeking sales engineering position or one leading thereto. Four years experience designer, engineer, sales engineer in heat treating equipment and power plant work. Present sales engineer truck axles.

B-458. GRAD. MECH. ENGR., 10 years experience machine design,

detail and construction work; would consider change. Age 34, married, best references.

B-459: YALE SHEFFIELD GRADuate B. S. degree in C. E., at present employed, will be open for propositions about June 1. Experience asst. surveyor; Alaskan Boundary, engineer; Chicago Tunnel, instrument man, chief of party; designer, estimator, and engineer various construction projects. Best references. What have you to offer?

B-460: C. E. EXPERIENCED IN concrete and steel and railroad terminal construction, valuation work. Now in charge of inventory and appraisal for government department, desires position in Chicago. Some experience in raw material, purchase and production work.

B-461: MECH. AND SALES ENgineer wants sales agency for steel or malleable iron in mechanical line. Experienced as sales engr., designer, inspector, shop supt. and office manager. Knows R. R. and general manufacturing trade. Has pleasing personality, good executive and not afraid of hard work.

SITUATIONS AVAILABLE.

A-50: DRAFTSMEN AND DEsigners wanted; preferably single man. Salary $250. Location, Ontario, Canada.

A-51: PRACTICAL COMMON sense builder, able to take off quantities and price same. Engineer and estimator preferred.

A-52: SALESMAN ESTIMATOR for general machine shop work, with large construction company in Pennsylvania.

A-53: WANTED—STRUCTURAL detailers and checkers experienced on structures for coal or ore handling machinery. Communicate directly with Allen and Garcia Co., 955 McCormick Bldg., Chicago.

A-54: TWO VACANCIES IN structural valuation work. Must be able to compute and price birdges, trestles and culverts based on plans and field notes. Work in Chicago office. Salary $160 and $170. Prospects for increases.

A-55: WANTED—ONE CONveyor man, not necessarily designer; one foundry draftsman; one young man with architectural experience. Must be able to make plat plants.

EMPLOYMENT SERVICE

As a service to the engineering profession in Chicago the Western Society of Engineers has been developing a personnel service in an effort not only to find the right position for engineers who desire a change, but also to secure, if possible, the right man for employers.

A letter of appreciation of the service which has been rendered has been received and is published herewith:

"Some months ago we asked you to put us in touch with a man who could handle design, manufacture, and testing of a special machine which we are developing.

"You gave us the name of a gentleman who has proved eminently satisfactory—he filled the specifications 'plus.' I wonder just to what extent the membership of the Society and others realize that you 'hand pick' men to fit a particular place?

"Through other sources it is much like answers to a classified, a person still has to weed out, but the men you recommend have been chosen with much evident care, and it only remains to reach a final decision. Evidencing further my strong feelings along this line, we are today asking for another good man."

The success of this work depends on the co-operation of our members to a large extent.

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The Return of the Railroads to Corporate Management and Their Problems

By SAMUEL O. DUNN,
Editor Railway Age.

Presented February 23, 1920.

ORGANIZATION of the Railway Engineering Section of the Western Society of Engineers has been made at a very opportune time. The return of the railroads to private operation after two years of government operation is immediately impending. We have a right to hope that after they are returned there will be a very large increase in the amount of work for railway engineers to do. If there is not, the effects of the failure to provide railway engineers with more work to do will be bad for the railroads, but very much worse for the industries, and the people that are dependent upon railroads for service.

Railroad legislation has been under consideration in Washington now for almost a year.

I am going to make in a very informal way a general survey of the conditions existing on the railroads at this time and after that I will present to you in some detail, information as to the precise provisions which the Joint Conference railroad bill contains. There seems to be a great deal of misunderstanding in regard to its exact provisions.

The present conditions in the railroad field leave very much to be desired. A little over two years ago when the President of the United States sent for the members of the Railroads War Board, which, at that time, was supervising the operation of the railroads, and told them that he had decided to take over the operation of the roads, he said that he was going to do so chiefly because of three conditions which existed, and three problems which required immediate solution.

The first of those conditions was the inability of the railroads, especially the Eastern lines, to satisfactorily handle the traffic which was being offered to them.

The second was the unsatisfactory financial condition in which the railroads were becoming involved because of rapidly increasing expenses. The Interstate Commerce Commission only a few weeks before had sent to Congress a special report in which it had indicated that it could not make the advances in rates which seemed to be necessary in order to protect the railroads from bankruptcy.

The third of the conditions which the President said made necessary the adoption of government control was the labor situation. Practically every class of railroad employes was demanding a large advance in wages. The President said to the members of the Railroads War Board, in substance: "These labor people don't seem to have much confidence in the executives of the railroads, and they do seem to have a little confidence in me."

What has the government done to solve these various problems? I do not intend to engage in any criticism of government operation, but there are certain facts which every man who studies this situation knows to exist. One of these is that the government has not solved the transportation problem,—I mean by that the problem of providing adequate facilities and operating them in such a way as to handle satisfactorily all the traffic offered. On the contrary, the shortage of railroad facilities is at the present time more acute than it ever was in the history of this country before. On the day when government operation was adopted the car shortage was reported as ninety thousand cars. On January 31, 1920, it was eighty-eight thousand cars. The accumulations of cars have been about as great within recent weeks as they were when the government took over the railroads.

The government in two years has ordered only 100,000 freight cars, as many as are normally required to replace those which are annually worn out and scrapped. The statistics do not show a decline in the number of cars in service, but every man familiar with the facts knows that that is because the government has kept in service many cars which under the conditions of earlier years would have already been on the scrap pile. It has bought a somewhat larger number of locomotives in proportion, but no more than are annually required for replacements. It has not during the two years of government operation bought a single passenger car.

For some years before we entered the war the rate of return being earned by the railroads had been declining. It declined from 5¾ per cent in 1910 to just a little over 4 per cent in 1915. That decline in average return earned was accompanied by a decline in the new investment made annually in the railroads from over eight hundred million dollars to less than three hundred million dollars. The result was that even in the latter part of the year 1915 the railways had become unable to deal satisfactorily with any unusual amount of traffic.

The year 1916 was one of prosperity and the companies began in the year 1917 to increase their facilities. That was stopped by our entrance into the war. As I have shown you, under government operation very little has been done to increase facilities. Since the year 1915, however, the increase in the freight and passenger traffic actually handled has been 45 per cent. The increase in freight cars and locomotives, even including those which have been kept in service but which in former years would have been retired, has been about two per cent. It is not surprising, therefore, that at the present time the railroads find themselves wholly unable to cope with the business. They are unable to move all the crops grown upon the farms. They are unable to move all the lumber produced, and a large part of the lumber mills in the Northwest have been shut down in recent months. The coal people constantly complain that they cannot get enough cars to operate the mines to capacity. The iron and steel mills have been troubled recently, very seriously, by car shortage. The President of one of the largest cement manufacturing concerns in this country said that his concern was shipping large quantities of cement in motor trucks at a cost five or six times as great as the cost of moving it in freight cars would be, because they could not get enough freight cars to handle it. So the roads are going back to private operation with facilities totally inadequate to the demands upon them.

With respect to railroad financial conditions, the facts, I think, may be stated almost in a word. In the year 1917, the last of private operation, the net operating income earned by the Class I railways, which of course includes all the large railroads of the country, was $975,000,000. In the year 1919 the net operating income earned by those same railroads was only $516,000,000, a decline of $459,000,000. In the meantime there had been an increase in the investment in the properties approaching one billion dollars. The government's guarantee to the Class I roads amounts to $905,000,000 a year. The difference between that guarantee and the net operating income in 1919 was $389,000,000. The deficit of the Railroad Administration, however, was larger than that. There must be added to it the cost of maintaining the Administration, the deficit incurred on sleeping cars, waterways, etc. Including those losses, that deficit would be at least $411,000,000. There is another very large item that must be added, and that is interest upon the additional investment that has been made under government control. The government has to pay, directly or indirectly, interest upon all the money that has been invested in the railroads under government control. That interest is running now, doubtless, although we have not the exact figures, at the rate of about $45,000,000 a year. Therefore, the real deficit in the year 1919 appears to have been about $460,000,000.

The railroads are facing this enormous disparity between income and the demands upon income at the time when they are about to be returned to their owners. Obviously, to return them without a continuance of the guarantees or without an advance in rates would mean immediate bankruptcy for most of them, because the amount earned last year would not be sufficient to pay the interest on the debts of most of them.

It was claimed that the companies had made a very sad mess of the labor problem. It was claimed that the government would solve, and it has been claimed since government operation was adopted, that it had solved that problem. The government established at Washington a Division of Labor and several boards composed equally of officers and employes, to whom were transferred authority over questions of discipline, conditions of employment and wages. These various boards have standardized wages throughout the country regardless of differences in local conditions. They have granted the eight-hour day and time and one-half for overtime. The annual additions to the pay roll made under government control now amount to about $1,200,000,000 a year. That includes the compensation of about 200,000 employes, or 12 per cent of the total number, who have had to be added chiefly because of the establishment of the eight-hour day.

It might be thought that after all that had been done the labor problem would be solved. We all know that it has not been. The employes recently have been pressing demands for further advances in wages which it is estimated by the director general would cost from $800,000,000 to $1,000,000,000 a year additional. Under government control strikes were to be avoided. As a matter of fact there were frequent sporadic strikes, and numerous threats of several strikes, the last one being only recently withdrawn because of the promise of the President of the United States to constitute a board to re-open the whole question of wages as soon as the railroads are back in the hands of their owners.

That, in brief, is the situation as respects facilities, financial matters, and labor matters, at the time when the railroads are about to be returned to their owners. Congress has made a real effort to deal with these conditions, to solve the problems presented by them in the proposed legislation.

It must not be forgotten that prior to government control the laws of this country required unrestricted competition between railroads. Those laws were enforced as strictly as they could be. Certain suits were pending in the federal courts for the purpose of dissolving combinations which had been formed by the railroads in alleged violation of the Sherman Anti-Trust Law on the very day when the government control was adopted. What was absolutely illegal on December 31, 1917, became entirely legal January 1, 1918. One of the first orders which the Director General of Railroads issued was an order absolutely forbidding any competition between railroads. Public sentiment apparently underwent a change over night. Just prior to government operation, public sentiment seemed to have favored unrestricted competition; immediately after it was adopted, the railroads became the object of criticism because, under private management, they had competed, in spite of the fact that they had to compete or have their officers go to jail.

The new legislation which is proposed would change all that. Under it the Sherman Anti-Trust Law as it applies to railroads, and the anti-pooling section of the Interstate Commerce Commission are repealed. The railroads are authorized to make any agreements with respect to the pooling of traffic, earnings, etc., which the Interstate Commerce Commission may hold will not be inimical to the public interest.

The Commission is also instructed to make a study to determine what consolidations of railroads will be in the public interest, and to draw up a general plan. After it has drawn up that plan no consolidations may be made which are not in accordance with it, but all consolidations which are in accordance with it will be permitted. Those, in brief, are the provisions in regard to consolidation.

Probably the most interesting and important provisions are those relating to adequacy of facilities and rate making. Good and adequate service is the one thing that the public needs from railroads more than all other things. It is an extraordinary fact, however, that so far as I know never up to this time has there been enacted by any law making body in this country a single measure respecting the regulation of railroads which has recognized the fact that to promote the provision of adequate railroad facilities should be one of the main objects of regulation. It has been required that the rates should be made "just and reasonable," but no law making body has ever said a word to indicate that just and reasonable rates were not only rates which would not be confiscatory or extortionate, but also rates which would enable the railroads to give good and adequate service. The proposed legislation establishes an absolutely new precedent in that respect.

The bill says: "In the exercise of its power to prescribe just and reasonable rates the Commission shall initiate, modify, establish or adjust such rates so that carriers as a whole, or as a whole in each of such groups or territories as the Commission may from time to time designate, will, under honest, efficient and economical management and reasonable expenditures for maintenance of way structures and equipment, earn an aggregate annual net operating income as nearly equal as may be to a fair return upon the aggregate value of the railroad properties of such carriers, held for, and used in, the service of transportation, providing that the Commission shall have reasonable latitude to modify or adjust any particular rate which it may find unjust or unreasonable, or to prescribe different rates for the different parts of the country. The Commission shall from time to time determine and make public what percentage of such aggregate property value constitutes a fair return thereon, and such percentage shall be uniform for all rate groups or territories which may be designated by the Commission. * * * In making such determination it shall give due consideration, among other things, to the transportation needs of the country and the necessity (under honest, efficient and economical management, of existing transportation facilities), of enlarging such facilities in order to provide the people of the United States with adequate transportation; provided that during the two years beginning March 1, 1920, the Commission shall take as such fair return a sum equal to 5½ per cent of such aggregate value, but in its discretion, it may add thereto a sum not exceeding one-half of one per cent of such aggregate value to make provision, in whole or in part, for improvements, betterments or equipment which, according to the accounting systems prescribed by the Commission, are chargeable to capital account."

The valuation being made by the Commission is not complete. Therefore, it has been necessary to make some provision with respect to the basis which should be used by the Commission in regulating rates until the valuation shall be finished.

Upon that subject the bill says: "The Commission may utilize the results of its investigation under Section 19-A of this Act insofar as deemed necessary by it, and shall give due consideration to all the elements of value recognized by the law of the land for rate making purposes and shall give to the property investment account of the carriers only that consideration which under such law it is entitled to in establishing values for rate making purposes."

The bill calls attention to the fact that under any basis of rates which is deemed to be reasonable for all the roads, some roads may earn more than they may be deemed to be entitled to, and adds: "If, under the provisions of this section, any carrier earns for any year a net railroad operating income in excess of six per cent of the value of the railroad property held by and used for railroad transportation, one-half of such excess shall be placed in a reserve fund and the remaining one-half thereof shall, within the first four months following the close of the period for which such computation is made, be recoverable by and paid to the Commission for the purpose of establishing and maintaining a general railroad contingent fund, as hereinafter described."

The Commission may make loans from this general contingent fund to railway companies for buying equipment, or it may buy equipment and lease it to them. It must so handle the funds as to derive from it a return of six per cent. In other words, the fund will belong to the government, and whatever use of it is made, the government will derive a return from it.

Many people appear to believe that these rate making provisions constitute a guarantee of 5½ per cent to each individual railroad upon its valuation, or book cost. That is not correct. They do not constitute a guarantee to all the railroads or to any railroad. They simply instruct the Commission to so fix the rates as to yield a fair return, and the law indicates that in the opinion of Congress 5½ per cent would be a fair return. The Commission, no matter how well it guesses, will probably never be able to fix the rates so that they will yield exactly 5½ per cent to any one group of roads in any year. It may make them so low that the rates will yield only five per cent in one year. It may make them so high that they will yield over six per cent in another year. If it makes them so low that they yield less than five and one-half per cent the railroads have no recourse, they are simply "out of luck." There is no power on the part of any group of railroads to, in any way or at any time, recover any part of the five and one-half per cent they have lost, except perhaps by influencing the Commission in a subsequent year to make the rates yield more than 5½ per cent.

I want to make that perfectly clear. There is a guarantee from the public treasury for six months. The law provides that the government guarantees now in effect shall be continued for six months after March 1st. Then all guarántees expire and after that all that is left is an instruction to the Commission to make the rates so they will yield as nearly as possible 5½ per cent to each group of railroads.

The question naturally arises as to how much of an advance in rates will be necessary in order to enable the railroads to earn the percentages mentioned in the law. While the Commission is required to make the rates high enough to yield five and one-half per cent, it may add an additional one-half of one per cent, which, however, must be directly invested by the railroads in improvements. I have assumed that the Commission would allow the roads to earn six per cent, and have made some calculations as to how much the advance in freight rates would be, and in what position the carriers would be left. The total earnings of the Class I railroads in 1919 from the rates then in effect amounted to $5,184,000,000. The total freight earnings amounted to $3,556,000,000. The net operating income was $516,000,000. The present book cost of road and equipment is about $19,500,000,000. To yield a return of six per cent on $19,500,000,000 would require $1,170,000,000 net operating income. Therefore, the net operating income in 1919 was $654,000,000 less than the amount required to pay six per cent, so that if the traffic and operating expenses were to continue to be what they were in 1919, the gross earnings must necessarily be increased $654,000,000.

All of the proposals regarding advances in rates which I have heard have been proposals for advances in freight rates. What percentage of increase in freight rates would be required to yield $654,000,000 additional net operating income? The freight earnings in 1919, as I have said, were $3,556,000,000. A 20 per cent increase in freight rates, therefore, would yield $700,000,000. The conclusion is unavoidable that if the roads are to be allowed to earn 6 per cent, there will have to be an increase of at least 20 per cent in rates, and in some cases more than that. In the New England states, for instance, the increase in rates may have to be 40 per cent.

Probably next to the rule of rate making the labor problem has presented more difficulties to Congress than any other part of the railroad problem. There were wide differences of opinion between the House and the Senate regarding what provisions should be adopted. The Cummins Bill as passed by the Senate absolutely prohibited strikes and provided for compulsory arbitration. The Esch Bill as passed by the House, in effect, established as the minimum wages to be paid from now to the end of the world the wages established by the Railroad Administration. That might not be detected on the first reading of the bill, but it was there all right, for the bill provided that there should be established boards to deal with wages and working conditions; that the companies and the employes should have equal numbers of representatives on those boards, and that no reduction should be made in any wages fixed by the Railroad Administration except by a majority vote of the boards. Manifestly, the representatives of the employes on the boards would never vote for any reduction in wages and therefore there would never be a majority vote in favor of a reduction.

It seemed as though it would be as difficult for the conferees to agree upon the labor provisions as upon the rule of rate making. However, they had practically agreed upon certain provisions when labor appeared before the Railroad Administration recently and demanded that large additional advances in its wages should be made at once. One organization issued an order for a strike, which was to go into effect on the day on which this bill was to be reported in Congress. The result was that the President promised the employes that he would arrange matters so that immediately after private operation was resumed the entire question would be reopened. Then there were conferences between the Director General of Railroads and members of the Conference Committee of Congress. From these conferences emerged the provisions in this bill.

These labor provisions first provide for certain boards of adjustment, on which the employes and the companies are to be equally represented. They are to attempt to settle all controversies regarding wages, conditions of employment, discipline, etc., which may arise.

There is also created a Railroad Labor Board which will have its headquarters in Chicago if created. This board is to consist of nine members, all of whom are to be appointed by the President of the United States. The President is to appoint three of them to represent the public. The railroad companies are to furnish him a list of six men, and from that list of six he is to appoint three to represent the companies. The employes are also to furnish him a list of six men and from that six he is to appoint three to represent them. It is provided that if any member of the board at the time of his appointment holds any office on any railroad or in any labor organization, he shall be required to resign his office and remain unconnected with any railroad or railroad labor organization during the period of his service.

The members are to be paid ten thousand dollars a year. One of the provisions is that no decision which may be reached by a majority of the members of the board will be of any effect unless one of the members appointed to represent the public concurs in it.

In other words, the three members representing the companies and the three members representing the employes, although they constitute two-thirds of the board, cannot render a decision alone if all of the three representatives of the public dissent. I think there can be no doubt as to the reason why that provision is made. Congress has provided that in any event the rates must be so fixed as to enable the railroads to earn 5½ per cent. That raised a new problem, because it would make it possible for a board composed entirely of representatives of the companies and the employes to agree to have no trouble and to raise wages. The advance in wages under this bill would be passed along to the public, and the provision that at least one member representing the public must concur, evidently was inserted for the purpose of preventing agreements between the representatives of the employes and the representatives of the companies to hold up the public.

The bill requires all controversies which are not settled by the boards of adjustment to be appealed to the Labor Board. The implication is plain that there must not be any lockouts or strikes. The bill does not, however, anywhere prohibit lockouts or strikes. Furthermore, it does not provide any penalties for violation of any of these labor provisions.

Organized labor has gone on recard as being opposed to the bill. First, it is opposed to the public being represented on the board. The contention is made that on a tripartite wage board the representatives of the companies immediately become advocates of the companies, the representatives of the men become advocates of the men, and it is left to the representatives of the public to decide the controversy. Now, the labor people contend that the representatives of the public do not know anything about the questions in controversy. Therefore, they decide them either on the basis of splitting the difference, or according to their social or financial prejudices, and, as is claimed, they are usually representatives of the capitalistic class of society, and therefore unfavorable to labor. Labor objects to the provision requiring one member representing the public to concur in all decisions. The spokesmen of labor advovate dual boards, that is, boards composed exclusively and equally of representatives of the companies and of the men. They are now asking that the President shall create for the settlement of pending controversies a board entirely different from that provided for by this bill. The result of that, in my opinion, would be to establish a precedent which would make these provisions inoperative.

In my opinion this proposed law is the most constructive measure that has ever been drafted in this country for the regulation of railroads. In fact, I think it is about the only constructive measure that ever has been adopted for the regulation of railroads. We adopted, without any specific provision of law to that effect, the policy, fixing the maximum return which railroads could earn. A minimum return was never fixed. The result was that under private management the return earned by the companies very rapidly declined from the time the Interstate Commerce Commission rendered its decision in the first important rate advance case in 1911 until 1915. There was a big bulge in traffic in 1916 and 1917, and a large increase in net earnings, but the policy which had been adopted by the Commission destroyed confidence in the future of the railroads. In my opinion, these provisions have been agreed upon, not only to restore the earning capacity of the roads, but to remove the terrible uncertainty with regard to their financial future which has had such a blighting effect upon railroad development in this country.

The rule of rate making provides for the regulation of the rates upon the basis of the valuation of the properties when those valuations are finished. It is to be assumed that meantime the Commission will take into consideration book costs, and the valuations insofar as it has proceeded with them, in determining what return shall be allowed to be earned. A reasonable measure of certainty, in regard to the future of investment in railroads is quite as necessary to enable them to raise large amounts of capital as a large return. In fact, certainty probably is more necessary. Several questions arise as to how these provisions will be administered. Nobody can read the bill without recognizing the fact that it puts an enormous power in the hands of the Interstate Commerce Commission. First, the Commission is to determine into what groups the railroads shall be divided. Secondly, it is to decide upon the valuation on which the return is to be based. Third, it is given the power after two years to change the percentage of return allowed if it believes that that is expedient in the public interest. Again, it is authorized to study the maintenance expenditures of the railroads for the purpose of insuring that they do not make excessive expenditures.

The Commission is also given very largely increased powers with respect to regulation of other matters. It is authorized to control the distribution of freight cars in periods of car shortage and traffic congestion. It is given authority to require the joint operation of terminals when and where it considers this desirable.

Upon the way in which the Commission exercises these powers will very largely depend the way in which this legislation will work. The Commission, in past years, has not won the approval of a great many students of railroad matters. Railroad officers have felt that it has not been fair. I believe, however, that most members of the Commission have learned a great deal from the experiences of recent years and that they are disposed to administer this bill in the spirit in which it has been enacted. Some members of the Commission are advocates of government ownership. Others have openly opposed the return of the railroads on the ground that it would involve a large increase in rates.

But some of the older and more conservative influential members have publicly advocated legislation of this very kind. Therefore, I really believe that we have very good ground for hope in regard to the future, financial, physical and otherwise, of the railroads. I confess that I have been a pessimist in regard to the railroad situation for a good many years. I am an optimist in regard to it now. I believe that it is possible under the provisions of this bill to make public regulation and private management a success. I believe that if public regulation and private management cannot be made a success under a measure as constructive as this one is, then they cannot be made a success at all, and the only possible outcome will be government ownership. I do not think, however, that the people of this country are anxious for government ownership. Their disappointment with government management has been extreme. The great danger in the immediate future is that the public will become disappointed and impatient at the kind of service that will be rendered after the railroads are returned to private operation. There seem to be a great many people who a few years ago thought that private management was very inefficient and government management would be very efficient who are now sure that government management is very inefficient and that private management will be much more efficient. The railroads need thousands of locomotives, tens of thousands of passenger cars, hundreds of thousands of freight cars. They cannot be built in a night. Therefore, no matter how much of a revival of the expansion of railroad facilities there may be after the return to private operation, it will be not merely months, but years, before the railroads will be able to render anywhere near as good freight and passenger service as they rendered up to 1917. Up to the year 1917 we never handled more than 56 passengers per train. We are handling 90 passengers per train now. We are handling about 35 per cent more passengers per car than we ever did prior to 1917. The cars for rendering better service do not exist. They must be built. The same thing is true with regard to freight service. If, however, the public will bear for a while with conditions which are unavoidable, it is my opinion that those conditions will gradually be alleviated, that the superior efficiency of private management will be demonstrated and that we will succeed finally in making a success of private management, subject to government regulation.

CLOSURE.

Presented by SAMUEL O. DUNN.

There is a provision in the joint conference railroad bill with respect to the labor commission that allows any 100 employes to ask for a board of adjustment. The unions are opposed to this provision.

The bill, in connection with the allowance of one-half of one per cent on the expenditure charged to the capital account, provides: "That the Commission may, in its discretion, add thereto a sum not exceeding one-half of one per cent of such aggregate value to make provision in whole or in part for improvements, betterments or equipment, which, according to the accounting system prescribed by the Commission, are chargeable to capital account." The Interstate Commerce Commission is given exclusive and complete authority to regulate the issuance of railroad securities, so that the Commission would have complete power to prevent the roads from issuing capital securities against an investment made from this one-half of one per cent.

States are forbidden to adopt regulations which will unduly burden or discriminate against interstate commerce. The Interstate Commerce Commission has full authority to enforce this provision.

The corporation planning to build a new property or to build an extension is required to get a certificate of public convenience from the Commission. The Commission has a certain authority to order physical connections, between railroads, and between them and steam lines.

As soon as the valuation is finished, the rates will be fixed. Thus far the physical valuation figures have exceeded the book cost in 42 cases out of 51. No matter how a valuation of railroads is made, the valuation of a large majority of them will exceed either the capitalization or the book cost. There is no provision in the bill with reference to the ratio between book value, or valuation, and the bonded indebtedness.

Where the passenger business is almost equal to the freight business, and freight rates are increased without increasing the passenger rates, there is a question as to how an adjustment will be made. The questions of the grouping of the railroads, consolidation and rate making are all interlocked. One plan advocated is that New England roads be combined with railroads in other territories. For instance, it has been proposed that the New York Central should take over the Boston and Maine. The Pennsylvania System should take over the New Haven. They would then be parts of those systems, and it is assumed that they would be included in the rate making group of which the New York Central and the Pennsylvania were a part, and the rates for the entire group would be so made as to yield 5½ per cent. In that case the advance in rates which it would be necessary to make in New England, would be smaller than if New England were made a group by itself, and the rates had to be advanced enough to enable the railroads in that particular territory to earn 5½ per cent. This arrangement, however, would virtually tax the people of New York, and the states west of there, for the benefit of New England.

The growth of the earnings in excess of 5½ or 6 per cent to be turned over to the Interstate Commerce Commission to be used as a loan for purchase of equipment, etc., will depend upon any number of conditions. If there are no consolidations and the general level of the rates will be made high enough to produce an average of 5½ or 6 per cent, then the net return earned by the rich roads will be substantially above six per cent, and the government will derive a very substantial amount of money from that fund. But, if the weak and strong roads are consolidated into a single system, one of them earning 5 per cent, and another 7 per cent, if they are equal in size the average earning would be 6 per cent. The merging would automatically cut off the government's share of the surplus earnings, where before the merger the government received earnings from the one earning 7 per cent. Or, suppose that there were six roads in a group operated independently, earning an average of six per cent. The government then derives nothing. Suppose one of them with improved management increases its earnings to more than six per cent, and the others by less efficient management decrease their earnings to five per cent, and the average earned by all the roads is still six per cent. The government, before the change in management, received nothing, but now that there is a road earning seven per cent, it gets half of one per cent from that road. The government is, therefore, benefitted by the deterioration of the management of one road, and the improvement in the management of the other road. No one can foresee how those provisions will work out. It will largely depend upon what consolidations are made by the railroads. This provision will probably stimulate the consolidation and taking over of the weaker roads.

The returns under government control continue to be guaranteed during the next six months. During that period the Commission is given power to control expenditures for maintenance. There are other provisions which very clearly give the Commission the power to investigate expenditures.

The bill does not afford an answer to the question of conflicting rulings between the Interstate Commerce Commission and the State Boards. In a case cited where a state board orders all grade crossings in a state eliminated, which would require an enormous expenditure, the question would not be one for the Interstate Commerce Commission to decide. It would be one for the courts—the question being whether that was a reasonable exercise of the state's police power. It is not known that there is a provision made for operating expenses incident to Addition and Betterment work, as in the case of the Chicago Track Elevation. This will have to be determined.

It is not thought that the bill will effect terminals, increasing of terminal facilities, or construction work, as expenditures for such work are capital expenditures, and it is assumed that the railroads will be allowed to make such capital expenditures for expansion of facilities as may be deemed proper in the exercise of good judgment. The law expressly requires economical and efficient planning and management, but it is thought no serious question will be raised about any terminal construction that may be done.

As time and opportunity affords, the requirements of state and municipal bodies regarding unproductive improvements will be used as arguments to the Commission for allowing the railroads one-half of one per cent for the purpose of meeting those expenditures. It is supposed that if the Commission authorizes the extra one-half of one per cent, it will insist upon knowing how it is spent.

If the Commission exercises the power that is delegated to it, it would then virtually be a guarantee, but not for any individual road. In other words, Congress says, "You must fix reasonable rates, and we hold that rates yielding a return of less than five and one-half per cent are not reasonable." It is assumed that the Commission will fix the rates so as to yield five and one-half per cent. The Commission may make a mistake even in the exercise of its best judgment. Rates may be made to yield more than that. If the rates yield less, no road or group of roads has any redress whatever except to ask the Commission to make the rates higher the next year.

The *rates of return* are fixed for two years, the *rates* are not fixed for two years. Suppose the Commission made an advance in rates of $600,000,000. If, immediately after that a wage board granted a large increase in wages, obviously it would be necessary to immediately get another advance in rates to put the net return up to five and one-half or six per cent again.

The law is modified to permit railroads to own and operate steamship lines, subject to the approval of the Interstate Commerce Commission, if, in the opinion of the Commission, that is in the public interest.

There is nothing in the bill to indicate that the National Agreements are extended past March 1st, but the wages are absolutely extended.

Wages are not subject to reduction for six months, the same period that the government guarantees the standard return to the railway companies.

Scope and Development of the Signal Corps, U. S. A.

By Lt.-Col. L. D. Wildman, U. S. A.,
Chief Signal Officer, Central Department.

Presented May 5, 1919.

PROFESSOR KENNEDY DUNCAN in a statement on the new knowledge says concerning matter: "If we acknowledge that the atom may be divided into corpuscles and that all corpuscles of all matter are exactly the same, we may imagine one swarm of them consolidated into a mass which men call lead and another similar swarm differently consolidated into man himself. These two masses transported by different routes may meet on the field of battle and both, by reason of that meeting, disintegrate and return to their original corpuscles, from which may arise by a new combination a woman, a butterfly or a snake." The new knowledge may not be entirely familiar to all of you, that is; the separation of the atom, which for hundreds and hundreds of years we have considered as the smallest particle of matter, into its constituent parts, the ions or the corpuscles, as we care to call them. We are now actually working with them, and our new wireless telephone is based on the fact that the ion or the corpuscle is a bridge for the transfer of speech from a man here in Chicago to an aeroplane a hundred miles away and thousands of feet above the earth. The ion is an entity, and the theory of the ion, if accepted, leads us into very devious and beautiful pathways, some of which end in speculation and some in new vistas.

I have quoted from Duncan for the purpose of comparing it to what may be called the granular theory of armies. Every army is composed of individuals, and the draft laws act more or less as a band filter. We get all the healthy specimens between certain ages. In all nations and in all groups of men, wherever found, it is probable that the one unvarying factor is the individual man. In other words, the individual man in any country, if he is physically perfect, can be trained to do just about what any other man in any other country can do. So we may consider as the main factor of armies that one unvarying corpuscle—man himself. Training puts the corpuscle into the atom and it becomes part of an organized body and those atoms may be again combined and formed into molecules or the higher bodies in that army. But it remains a fact that from the time of Caesar, from the time of the first armies, the individuals in any army were practically the same, and that it is the weapons and the agencies provided by engineers and scientists that make the superiority of one group over another group. What I want to impress is the fact that the scientist, the engineer, the man who furnishes a new death dealing device, is the man who makes armies; and in talking of preparedness, and the necessity for preparedness, I am talking as an engineer concerning the scientific appliances which will beat the other man's scientific appliances. The necessary engineering must be done before war is declared, and not afterwards, as this war has very well proved. We have lost innumerable men through the fact that our preparations were commenced after the war had started.

The creed which was outlined by the chief signal officer of the army at the beginning of the war and sent out to all the heads of departments at that time as a guide for the new work in which we were about to embark, was this: "To foster individual talent, imagination and initiative; to couple with this a high degree of cooperation, and to subject these to a not too minute direction; the whole vitalized by a supreme purpose which will serve as the key to unlock the upper stratas of the energies of man."

The Signal Corps at the outbreak of the war had but 12 regular officers and 1,200 men. Those figures inside of three months were expanded into 15,900 officers and 200,000 men in order to carry on the work which was dictated by Congress overnight. Three months after the outbreak of the war the chief signal officer had in his possession $680,000,000 to expend, a third more than the Panama Canal cost and it all had to be expended inside of ten months instead of the ten years it took to build the Canal. The situation was appalling, particularly in aircraft. The United States had built shipyards before and had built ships in them. We had made almost every kind of manufactured article known; we had made automobiles, cannon, we had made almost all the accessories of war except the airplane, and at the outbreak of the war we had but a handful of flyers, an extremely small number of aeronautical engineers, and practically no manufacturing establishment in which to make planes or engines and put them together. The Allies were crowding us because they had used up all of their material in making their own planes and they wanted us to help them out. It therefore devolved upon the United States not only to make the planes for its own program but to make them for the Allies as well. To show you the magnitude of the figures that were plumped down into the chief signal officer's lap I want to put down a few that I have culled from his report.

In order to make the aviators themselves—we had to get them just as fast as possible—we selected at the start every man who applied who came up to certain physical tests. At that time nerve was considered the principal thing in a flyer. We selected up to and including the day of the Armistice 16,637 men for training. These men had to be sent to schools and we had but this small handful of trained men to start them with. The fields were not built where they could fly and innumerable questions of policy came up at that time which could not be answered from experience. One of those was how many machines can profitably be flown from a field at one time and still give each man the highest number of hours of actual flying, considering the number of machines and the number of instructors then available. You can see it was a question of maximum and minimum. This had to be done and had to be done immediately. The one big feat, I think, that the Signal Corps did at that time was the establishment in record time of the fields with their hangars and the executive management of fields, students and instructors. We had to cut to the line at the start and make no man who was a flyer have any other duty than to teach flying. The executive management of the fields, the quartermasters, etc., had to be barred from the flying class and taken from some other class of students. As a result we graduated 8,602 actual pilots of machines. Fifty per cent of the men admitted and who went through ground schools actually became flyers. These men in their training flew sixty-six million miles in airplanes, and the casualties were practically one for every 3,300 miles flown. In other words, although the number of casualties was sadly large, the *percentage* of casualties was materially less than the casualties of any other nation which had men in training. You may have heard that our planes were structurally weak, but the statistics do not show it.

These statistics are taken from absolutely reliable sources. Of the entire number of casualties ninety per cent were the fault of the aviator. Thirty-five per cent of those can be traced to tail spins, nineteen to collisions, fifteen to nose dives and only two per cent were due to collapse of the machine. One of the direct results of finding out that ninety per cent of our casualties were due to the fault of the aviator was the development of a machine which is very much like the gyroscope. In this machine the aviator can get all the sensations of the nose dive, the tail spin, the side slip and all the rest of them on the ground and can get every movement of the machine except that of the horizontal translation. That machine is going to save innumerable casualties to men who are accustomed to flying, but not accustomed to stunting. No man can tell until after he has tried his first tail spin, whether he is going to stand the gaff. It is a question of his internal ear arrangement, and nerve has very little or nothing to do with it. As soon as we found this out we immediately put into the air service probably the most important man in it, the medical director of the flying unit. It is the duty of that medical director to select the flyers, whether high, low or medium, to keep them fit and in condition and to absolutely forbid a flyer going up when the tests show he is not fit. That is something that no other army had ever done until we started it. It has saved many men, and was really more important from the army standpoint than any other factor in that it saved planes, and we didn't have any to lose at that time.

The experiments which are tried on the pilot are developing rapidly. We now give him the flask test, which is really nothing but a deprivation of oxygen. We find that the ability of a man to go to high altitudes is ninety-nine per cent the effect of efficient oxygen supply and nothing else, so we know that if we give him the oxygen he can fly at great heights. In the olden days it was not necessary to make these tests, because we never flew above six or eight thousand feet, but as the "Archies" increased their range and as the enemy machines commenced to mount higher and higher, our own machines had to mount higher and higher. We find that the percentage of all the pilots who can fly at 22,000 feet is only about ten per cent of the entire number. We had to start right there to make certain inventions to meet those conditions, because we needed more men in the upper air than in the lower air, for we were taking over from the French practically all the upper air activities. So we immediately devised oxygen apparatus attached to the helmet of the aviator which took away ninety-nine per cent of his difficulty in flying high. We also found that after an aviator had flown at 22,000 feet for any length of time there was no possible way of keeping him warm, and he had to descend simply to increase his circulation. We then adopted the mechanically warmed clothing, which consisted of electrically charged wires fastened to a storage battery in the machine running through his clothing.

We also developed the puncture-proof tank, now on all planes. Those were all little things developed by the war, and which we could have foreseen, providing we had had an efficient preparedness in airplane service.

In 1907 the Signal Corps put out the first specifications for a heavier than air flying machine, and as the result of that the Wright Brothers put out the first airplane. The first Wright machine was a success, a decided success, and from that day for nine years it was dropped by our own authorities, with the exception of the expenditure of a million dollars. That was all that was spent by us. France saw the possibilities of the airplane in war. I will not make any comparisons as to the amount of money that France spent and that which we spent, but the result was that France had the superiority of the air at the beginning of the war and it left us with practically no nucleus even to build upon.

An airplane is not simply "engine"; it is not tank; it is not pilot. It takes a tremendous amount of material, and the Signal Corps absolutely was at a loss as to know where to get the material, because by the time we got into the war Great Britain and France and Germany and Austria had used up practically all of the material in existence they could get their hands on. To give you an idea of the amount of material needed I will state that the spruce production force alone one year after the war started consisted of 19,305 officers and men, who had built railroads into the forests, had erected saw mills with a capacity of nine million board feet a month—and two-thirds of that went to our Allies. There were 180,000,000 board feet of spruce cut up to the time of the signing of the Armistice. That was all an entirely new organization for the production of a certain thing which had to be gotten out, and gotten in a hurry. And the difficulties we encountered in getting that out were very much greater than would have been the case had we been given a little more time, because you can imagine that getting that quantity in record time meant much useless expenditure of money in the things that had to be done over, and changed. In addition to that we had the I. W. W. who went through the woods and at night spiked trees with iron and steel rods, puttying up the holes and putting the bark back on the tree. When the logs went to the mills the first thing we knew the saw was ripped out and somebody killed.

Besides spruce there were some ten million feet of mahogany used for propellers, and 3,187,000 yards of linen used. All the flax, all the linen in the world had been used up, practically. Most of it came from Russia, the little that came from Ireland had been used up long before. The engineers of the United States were put on the problem of making a cotton substitute that would equal linen. Now if you have never gone into the tearing qualities of cotton versus linen you will not know what the job was. But they immediately got hold of the cotton manufacturers of New England, the chemists and engineers, and we designed and developed a cotton fabric at half the cost of linen, with twice the tensile strength and three times the tearing resistance, and which "doped-up" tauter than the linen. We had 3,100,000 yards of it made up ready for use by the time the Armistice was signed.

Another difficulty immediately arose. There was not enough oil. At that time we thought castor oil was the only kind that could be used for engines. But the castor oil was unavailable. Every bit of castor oil that could be used for internal combustion engine work had been grabbed. The Signal Corps planted 108,000 acres of castor beans after having imported the beans from India. Then the oil engineers of the country got busy on a substitute for castor oil, and they developed an oil before our crop of castor beans was grown that was better for all kinds of engines except the rotary motor. That could all have been done before the war started and would have avoided planting that 108,000 acres of castor beans and the importation of seed from India. There was no earthly reason why it should not have been done, except that the country didn't want preparedness and wouldn't have it.

I want to say here what I said not long ago in a speech to my own fraternity. I said to them "You men are the government, each one of you is a part of the government, and you as the government must see that we are prepared for the next war better than you were for this, or you will have the same kind of failures in men and money that we have had in this war." About three weeks later I got a letter from Washington asking why I had criticized the Administration. I want it distinctly understood that I am not criticizing the Administration. The authorities did the very best they could. I am criticizing the individual man who did not see to it that he and his neighbor got preparedness. I will say the same thing now, and I am willing to stand by it before any court that may try me for talking too much. If it is not right to say that, I have no business in the army.

In addition to all these things there was 7,000,000 yards of cotton furnished before the Armistice was signed, and 2,647,000 yards of balloon fabric. I don't suppose you have ever heard of balloon fabric or of how badly we needed it. And yet if we had not made two balloons a day we wouldn't have been able to hit the German batteries, because those balloons were used for observation purposes and were of the utmost importance. Yet the things that we went through before we got balloon fabric reads like a romance. As you know, the rubber industry is probably the closest mouthed industry as far as its engineering secrets are concerned that there is in the world. The man who knows about the other fellow's mixing room is far more valuable, is worth thousands of dollars more to his own firm than he was before. Yet the manufacturers let the Signal Officer into every secret place, and allowed him to use the best processes and mixtures for his purposes.

These balloons go up anywhere from three to seven thousand feet with two men in them. They are connected telephonically with the big guns situated probably ten miles in their rear. By means of the coördination that we have and our scientific instruments we tell each gun, whether it has hit the mark or not, how much to change the range; we tell them when the mark is wiped out, and when to turn their guns on to something else, and we give them the range of that something else. It is very important for the enemy to destroy the observation balloon before the information goes back to the battery to which it is attached. The observer in the balloon is a marked man; he is being shot at from the moment he goes up by every conceivable weapon from the "Archies" down to individual rifle fire. We train our balloon observers to jump out of the basket when the balloon begins to fall, generally in flames, and to come down in their parachutes. One man said he had seen six men coming down at one time within range of his own vision.

We come to the accessories—altometers, 20,180 of them. Speaking of large numbers, three months before the Armistice was signed, we put out an order for 400,000 miles of insulated wire, four circuits to the moon, and we were almost up to our monthly production at the time the Armistice was signed. Over there we chewed up ten thousand miles of wire and six thousand telephones in one day and practically had to relay all the insulated wire from the North Sea to Switzerland every month. Almost every ten feet on the firing line had to have its connection back to a P. B. X. board in the rear, from that to another P. B. X. board, from that to the Main Board and from there directly back to the White House. I understand that the President sent a telegram to General Pershing on the front and got a reply in less than thirty minutes. The number of air speed indicators was 9,000; oxygen apparatus, 5,000, and 810,000 bombs were made in this country. You will see that that is comparatively a failure in the manufacture of bombs in comparison with the number that were actually used, but in round numbers it is a tremendous achievement. The trouble is that the desire and requirements are so much greater than the possibility of manufacture after war is commenced, that no matter what your desire or ability is, your manufacturing plants are not in existence and it can't be done. Liberty engines were 18,000 in number, or an equivalent of 5,700,000 horsepower on the block. Yet there is complaint about what the Signal Corps did and about the way in which they handled the internal combustion engine proposition. That in itself is a story which has all the elements of romance in it, because it has imagination; it has all the elements of tragedy, because of the final criticisms on the men responsible for the program; it has all the human elements in it, and some day when that story is written up it will be one of the most interesting documents in the world. Two men got together in a room in Colonel Deed's apartments in Washington and in thirty-six hours had completed drawings for the Liberty Twelves, distributed them to ten manufacturers. The first Liberty Twelve was delivered on the blocks for testing just exactly eighty days afterwards, and immediately developed the qualities which they had expected it would, but which have been increased by twenty-five per cent by subsequent improvements. For imagination, for forethought, for engineering ability, for minuteness of detail I don't believe that achievement has ever been equalled.

There were 367 balloons completely made, equipped with cars, auto attachment, telephonic attachment and all the apparatus necessary, in less than ten months from the time the first one was made.

Of course we had the aid and assistance of every other country where we could find engineering ability. I don't mean to say that the Signal Corps did it, but somebody had to do the executive work.

There is another very romantic and interesting series of experiments which were carried on and which resulted far beyond the expectations of anybody concerned. You know it is only within a few years that we have known anything about the non-valent elements that we find in the air, such as helium. At the outbreak of the war only a few cubic feet of helium had been separated, and that cost $1,700 per cubic foot. Some engineer in Great Britain got to the Chief Signal Officer and said, "Let's make that for balloons instead of using hydrogen." It is non-inflammable and it doesn't corrode the envelope of the balloon. You can put it into a balloon in tubes and there is no reason why you couldn't fly around the world. That theory was advanced and somebody said "Absurd," but somebody else said, "Go ahead and try it." As a result we had 170,000 cubic feet of helium produced at a cost of ten cents per cubic foot at the time of the signing of the Armistice. Those are things that you have not heard of, things done by somebody you have not heard about, and those somebodies were engineers.

We are all accustomed to air, and yet it is a most wonderful medium. When you think that the air is sensitive enough to transmit the pitch, the harmonics of a chorus of two thousand, with an orchestra of one thousand to your own ear and to retranslate it back into sound so exactly that you can listen to an individual voice in that chorus or to a particular harmonic of a violin, you have got to agree that it is a tremendously sensitive medium, and yet when moved in volume, at rates which are of considerable velocity, it can cut down trees and raze cities. Before the war we knew very little of the air, and we had to establish an air laboratory. We got the best scientists there were in the world; a Board of Air Research, 550 physicists, were requisitioned by the chief signal officer, given a two months' course and then sent to France. One unit of these physicists is supplied to each aviation post, each gas service post, each artillery post, each sound ranging post. I suppose you never heard of the sound ranging post. That is a new development by which guns of certain caliber are measured—that is, their distance and location are measured by the intersection of two lines drawn by means of the difference between the tremor caused by the earth and the tremor caused by the detonation of that same gun in the air. Professor Milliken of Chicago probably knows more about that than any other man. By means of this contrivance we found where the Big Berthas were and where their major guns were camouflaged. Almost every gun had its particular handwriting on the seismograph; you could tell almost what gun was being fired by the line it made on the paper.

There were in France twenty upper air stations furnishing forecasting data for weather. You can imagine what a necessity there was for accurate prognosticators of the weather, to airplane men particularly. When you consider that almost every operation along the front was based on photographic representations of the field, as nearly prior in time as could possibly be obtained, you will see the importance of this work. The British before San Mihiel took 17,000 photographs of the terrain over which they intended to go and made a relief map of the same before they started. Every day the territory covered was remapped, each photograph re-examined for new camouflage, and those additions and subtractions changed on the map so it was absolutely up to the minute when the men started over. You couldn't use the ordinary camera or plate under the conditions of fog and smoke and atmospheric conditions such as we had to deal with, so Professor Ives and a number of other men invented the color screens and the filters which would allow the lens of the camera to pierce smoke and fog and get photographs where the ordinary camera would have been absolutely useless.

In one instance we invented the propaganda balloon. That is a balloon that will be in common use before very long. There will be a regular propaganda balloon service between this country and other countries. These balloons will drop their automatic instruments after they have traveled at a certain level for a certain time in a foreign country and the data they have collected will be taken care of by scientific men in those countries. We have mapped the air lanes over the United States pretty thoroughly. We have found that most of the prevailing winds at 16,000 feet are from west to east and that some of them reach the velocity of 153 miles an hour. When you consider that an airplane would stand still in a wind of that velocity if it were flying 153 miles an hour, and that it would be moving over 300 miles an hour if it were flying with the wind, you can see the difficulty of starting a bombing plane for a certain destination. All the recording instruments and the means for keeping the machine at a certain level have all been worked out, and they have actually made flights from Kansas to New Jersey and deposited their instruments in perfect order and in perfect shape. For the aviation mail service they are going to be absolutely indispensable.

The application of these forecasts is of course obvious. The physiological study of flight has made special committees necessary, and although it is largely in the hands of the medical profession, yet we have had ten or fifteen engineers constantly on duty with the medical profession, who have had charge of avoiding making the same mistake twice. The medical department found that in one accident a man's head was very badly battered by the cowl on the machine. As soon as that report was made to the commanding officer it was the duty of the engineer in charge to make some change—or to do something that would make the result disappear the next time. Another accident resulted in internal injuries caused by his own safety belt. Immediately the engineer put shock absorbers on the belt. Next it was found that accidents were caused by breaking of the aviator's goggles. We then invented a nonbreakable glass goggle. In that way there are some thirty improvements that have been made as a direct result of experience.

Only about seventy per cent of the flyers who were originally accepted for training became pilots. It is rather interesting to know that the percentage was so high. Seventy per cent of those who applied and passed physically made good.

The Bureau of Standards has been a most important auxiliary to the Army. If there are three or four men who stand out prominently in the engineering line as active assistants and who deserve anything that can be given to them in the way of honors, Stratton of the Bureau of Standards is one of those men. He had foresight and acumen, he had the willingness to try, and, above all, he had the trained force before the war started. His force was small but it was a trained force, and he knew where he could get others. Some of the things that were given to him were the investigations on radio tubes. There is a thing that one could talk on for nearly a week, just on the manufacture, the difficulties and the theories on which the different radio tubes have been developed and their uses. There are four classes of radio tubes—the detector, the amplifier, in which faint sounds are made loud; the regulator and the oscillator. All of those tubes have different uses, different methods of manufacture, different substances, have been made by different people, developed along lines found necessary by previous experience, and not in ones and twos, but put out in quantity immediately. We have actually built millions for all the governments of the world. They are used on the land telephone lines as relays as well.

The next thing that the Bureau of Standards did was to build a wind tunnel and start experimentation on all of the things for which a wind tunnel could be used in connection with aircraft, and their name is legion. Professor Brooks of the University of Illinois came to me with a new variable pitch propeller which was about a foot in diameter, which gave all the necessary elements for a nine-foot propeller. It meant more or less a revolution in the whole history of propellers, but he couldn't find a place to test it. It was a thing that could not have been put into production at that time. But Brooks went right to Stratton. Stratton passed on it and they have now started those experiments.

Mr. Stratton also started experiments on a determination of accuracy for bomb sights. Now the bomb has to be dropped from a plane going anywhere from one hundred to three hundred miles an hour, and in order to get basic data you have to get the correct position with relation to the object which you want to hit. The result of his experiments was an attainment of three times the accuracy that had been realized previous to that time. The application for that is that, if you have three times the accuracy, you have the necessity for just one-third the number of planes for getting the same effect. Machine gun sights were also developed along similar lines.

Take the automatic speed adjuster. All wireless is run from the airplane itself; whether telephoned or telegraphed, the current has to be generated by the revolution of the propeller, a sort of windmill arrangement. This speed adjuster is delicate enough so that the windmill, no matter what rate it turns at, will always give the same number of revolutions, or the same speed to the generator.

They have calibrated forty thousand pilot tubes. These have been calibrated for speeds up to three hundred miles an hour for airplane work, with all degrees of rarefaction of the air and automatically put down on a dial so the pilot has to make no corrections at all. That has all been done since the war. These variable propellers, radiator designs and everything of that kind have been tested in this same wind tunnel. I don't know of any other tunnel in the country except the one at Leland Stanford. The American Society of Electrical Engineers took a very active part in these experiments and had 317 of their men in as officers.

The Liberty engine of course is the one we hear the most about, but we have gone into production in quantity scale on four other engines for various purposes, but for the principal reason that no one engine is probably the correct engine for all kinds of planes. We have actually delivered about 30,000 completed engines, 16,500 of them being Liberties, up to the signing of the Armistice.

There was another committee in existence called the National Advisory Committee far Aeronautics. It has gone into the more abstruse problems in a scientific way and has delivered papers on the subject for discussion by engineering bodies, such as the testing of fabric and aluminum and its light alloys. It has given as much information as it had and has disseminated it broadcast throughout the country to engineers. It has been a very important committee. That committee has now in progress sixty-four problems which are to be solved by the engineers of the country.

In other branches of the Signal Corps we have developed a daylight signaling lamp which uses the violet ray. All you have to do is to have the violet ray eye and you can send dots and dashes in any direction you please and the violet ray eye will pick up the ray five miles away.

Do you know that I can sit in my office, use the regular Bell telephone, get connection with Mineola and talk to the pilot of a machine a hundred miles away and twenty-three thousand feet high? One can actually distinguish the voice. That is very important and very valuable when the enemy is trying to confuse you and give you the wrong information. All those things have come in the past two years, and I think I am perfectly safe in saying that the result of this war from a scientific standpoint has given us an impetus which would not have been given in twenty years of non-intensive work. The question is: Are we going to stop all that work? Are we going to let these men who have been doing this development work stop it, drop it, go back to their ordinary jobs and let their mantle rest on someone else? Are you going to believe that Congress is going to let every man who has an idea develop it himself on his own money, or is Congress going to furnish us with money to continue the development of these things which I have outlined briefly? Gentlemen, what Congress does is dependent upon you. You have forty or sixty thousand members you can call on directly along these lines. The Administration is going to listen; the world is going to listen, and we are going to have for the next war a preparedness which will be very much greater than the preparedness which we had at the beginning of this. When I say the next war I mean exactly what I say, because I don't believe that man has changed, and if I am right in my granular theory of armies, the man, the individual corpuscle in our body politic, is going to stay just about as he is, and he is going to fight for his honor, his women and his food, no matter if you take away all his armies. It is up to us, if we are going to fight, to see that our individual units —our corpuscles—after they are trained and formed into atoms and molecules, are furnished with as good, at least, scientific appliances, as those with which other armies have been furnished by their scientific men and their governments.

April 20, 1920

Chairman: I think that we should take very seriously into our own hearts and minds the words of warning which Col. Wildman has given to us with regard to this matter, and that, as engineers, we should consider that we have a great deal more of a responsibility than we ever had before. What we have done is simply an indication of what we will be expected to do in the future, and if the engineers have assisted in winning this war—and there is no doubt in anyone's mind but that that is true—we should do everything that we can to prevent another war; that is, make the outcome of that war so well known, fixed beforehand, that the other fellow will not knock the chip off our shoulder, and that he will not attempt to force us into a place where we will have to defend ourselves, or where he can attempt to take that which belongs to us. The waste of this war is beyond our comprehension. It was due to unpreparedness. We were satisfied with things the way they were. Our own intentions were not to start anything of this kind, and we didn't believe another person could do it, and we went to sleep very quietly.

Octave Chanute, who probably did as much as anyone else in the development of the airplane, read the first paper that was ever presented on the science of aeronautics before this society. The basis of his investigations out here on the sand dunes were turned over to the Wright Brothers, and Colonel Wildman has told us what happened upon the first attempt of the Wright Brothers to fly. We considered that we had this thing sure. We had proven that an airplane was a possibility, a success, and our government went to sleep on this matter. Colonel Wildman is right again when he says that the government is ourselves. I sincerely hope that it will be the attempt of the engineering profession to see that this thing does not come again and that our nation will be prepared. These experiments will be worked out in such practical solution that no one will attempt to start war, at least with us, and the probabilities are that any war that is started in the future will be directed toward the most intelligent nation in the world, and I don't think there is any question but that America is that nation.

I was interested when Colonel Wildman was telling what the other departments of the army took from the Signal Corps after they had started to use it. That reminds me that the children of Egypt were required to make bricks out of straw, and they did it. The Signal Corps proved that they could make almost anything without the material to make it from. It is quite a wonderful achievement.

Question: I would like to ask Colonel Wildman if the cylinders for the airship motors are still forged from solid billets or have they some other method?

Col. Wildman: They are tubing. That was a new development of the Liberty Twelve; the Liberty Twelve has tubing for the cylinders.

Mr. Randolph: Can you tell us how thick that tubing is?

Col. Wildman: I don't know.

Member: I noticed Col. Wildman did not mention the depth bomb, but I would like to have him tell us a little about that.

Col. Wildman: The land planes do not make use of that to any extent. That is all navy; the naval seaplanes are the ones that make use of the depth bomb; also the destroyers. However, the depth bomb is comparatively a simple device. It simply throws over a cylinder containing a detonator as a fuse and a charge, and at a certain pressure beneath the water, which can be regulated by the water above it, the water can enter through a stop valve. That touching of the water to magnesium starts the flame which starts the denotation. Of course there might be three or four methods of fuse, but that is one of the methods.

Question: I thought possibly you would bring out the method in which this charge of T. N. T. is ignited.

Col. Wildman: That is part of ordnance. As you can see, I have had my hands pretty full on my own job. We have been getting about sixty pamphlets a day from the general staff, and the inscription on each one is, "Every officer is supposed to be familiar with the instructions contained in this pamphlet."

Question: Is that transmitter used in wireless telephony the ordinary carbon transmitter?

Col. Wildman: Yes, on that circuit, but that circuit is in direct connection with an oscillating power tube, and that power tube is placed in an inductive circuit containing capacity inductance, which gives it the high frequency. You can limit the wave practically to a definite wave length within a very small percentage, which enables us to send out practically a definite wave length, whereas in the old spark gap we had many variables.

Question: How is it that only the operator's voice can be heard and the noise of the engine and the vibration of the wind cannot?

Col. Wildman: You can have a monotone receiver which by means of these wave filters that I have been speaking of exclude all above and all below certain wave lengths. If you have a very low frequency like the hum of your propellers, that is not an electrical frequency at all, and the only thing you have to do to keep the propeller noise out of your own ear is to put on a protecting ear pad. Any of the electrical frequencies can be taken out to a certain extent by the filters. But you can get accustomed to listening for one tone, and if you have three frequencies of rather different pitch it is not hard to learn to read or to read through the pitches that you don't want to hear. For instance, in experimenting on Long Island there were about seven wireless stations going most of the time during the day, and you could recognize every one of them by their pitch, and listen to your own by its particular pitch. It didn't make very much difference as long as one didn't come in with an intensity that was so much greater than the others that it drowned the others out. As the telephone itself is efficient as the cube of the pitch, and the receiver itself by a high tone, we are all going to have high toned receivers and high toned senders. The human voice is not of as high frequency as a good many of the radio sets, but in that case the things that are excluded are those of the very much higher frequency which come in as radio frequencies used in the ordinary commercial sets.

Chairman: With regard to the cylinder of the airplane, Mr. Kettering explained a little bit with regard to that in his address before us. I think the German model which this was adapted from was to turn it out of a billet. The billet weighed about 140 pounds and after they got through with it the cylinder itself weighed only about fifteen or sixteen pounds. The development of the Liberty Motor was to make it out of a seamless tube, but the problem was to close one end of that tube and make a cylinder out of it. At first we tried to close it in equally from each side, but it was found that the center of the point of welding was a weak point. Then a very bright man conceived the idea of cutting it on the bias and making the larger flap come off to one side where they wanted the port, and they drilled out the weak part of the cylinder for the port.

Proceedings of the Society

Meeting No. 1059, January 5, 1920

This was a general meeting of the Society. Two hundred fifty-three members and guests were present. F. K. Copeland presided.

Mr. Charles Piez, President Link Belt Co., formerly chairman of the Emergency Fleet Corporation, discussed the "Tentative Report of the President's Industrial Commission" both from the viewpoint of the employer and the employee. The report was submitted to President Wilson on December 22, 1919, and was made public December 29, so that it was of immediate and important interest to the members of the Society. The speaker brought out the necessity for considering the "human element" in formulating provisions for the settlement or prevention of strikes. In the past, he said, the parties to the controversy and the public have never been fully satisfied as to the settlements made because the human issues were never considered. He expressed the opinion that the commission in its preliminary survey had made more equitable provisions for the solution of wage controversies. Underneath it all, he declared, was the fact that employee and employer have never been able to determine what was a fair share of the world's goods to be paid in return for services rendered. Corporations and business concerns must, in this new era, allow their employees an understanding of production costs and impress upon them the need for continued and increased production. The report and Mr. Piez' address were discussed very thoroughly by those present. It was agreed that parties indirectly affected by the results of wage controversies and disputes—that is to say, the public—should play a prominent part in the solution of these problems. The meeting was adjourned at 9:30 P. M.

Meeting No. 1060, January 12, 1920.

This was a meeting of the Bridge and Structural Section of the Society, 97 members and guests being present. Mr. G. A. Haggander, chairman. The regular order of business was election of officers for 1920. A unanimous ballot was cast for the following: Chairman, A. W. Dilling; Vice-Chairman, J. E. Love; Director, 3 years, H. H. Hadsall. The other directors of the section holding over are: Director, 2 years, C. W. Shepherd; Director, 1 year, J. C. Blaylock. The executive committee of the section is composed of the above officers. Prof. Duff A. Abrams, Lewis Institute, presented a paper, "Experimental Studies in Concrete Design at Lewis Institute," illustrating it with slides which brought out the results of tests recently made at Lewis Institute. The paper was provocative of much interesting discussion.

Meeting No. 1061, January 14, 1920.

This was a meeting of the Gas Engineering Section of the Western Society. Mr. H. H. Clark, retiring chairman, after calling the members to order, turned the meeting over to Mr. C. C. Boardman, chairman for 1920. There were 60 members and guests present. Prof. Kowalke, who is professor of industrial chemistry at the University of Wisconsin, illustrated his address on "Principles of Combustion," with lantern slides, which showed the types of furnaces used in his tests, diagrams showing temperatures suited for certain kinds of work, and photographs showing the working equipment of the department of industrial chemistry at the University. He also described the system of teaching the subject at the University. The discussion was protracted and interesting. The meeting adjourned at nine o'clock.

Meeting No. 1062, January 19, 1920.

This was a meeting of the Hydraulic, Sanitary and Municipal Section of the Society, there being 225 members and guests present. Mr. Linn White, chairman. The regular order of business was election of officers for 1920. A unanimous ballot was cast for the following: Chairman, William Artingstall; Vice-Chairman, L. R. Howson; Director, 3 years, A. J. Schafmayer.

The other directors of the section holding over are: Director, 2 years, W. D. Gerber; Director, 1 year, Walter Buehler. The executive committee of the section is composed of the above officers. Mr. Faherty's paper on "Chicago Municipal Improvements" was in no sense a technical paper, as he explained, but it was one of the most interesting presented before the Society during the season. He dwelt upon the value to Chicago and its citizens of the improvements in the making and to be made on Western Avenue, Robey Street, Ogden Avenue, South Water Street, Michigan Avenue and Twelfth Street. Incidents showing the distrust of the residents of these sections for the city in its undertakings for a betterment of traffic conditions, were brought out. The court procedure for such improvements was outlined and in this manner Mr. Faherty showed the reason for such long delays in getting improvements started. He stated that values along thoroughfares which have received the benefits of municipal improvements have increased from 50 to 400 per cent, depending of course, upon the location of the property in question. On motion of Mr. William Artingstall, a rising vote of thanks was accorded Mr. Faherty for his interesting talk.

Meeting No. 1063, January 28, 1920.

This was the annual meeting of the Western Society of Engineers and was held at the Hotel Morrison, there being 375 members and guests present. Mr. Frederic P. Vose presided as toastmaster, introducing first, Major General Leonard Wood, U. S. A., who spoke on "The Army and the Engineer." The General brought out the helpfulness and constructive efforts of the engineer in all colonial development of the United States. He used Cuba as an illustration of their accomplishments. General Wood urged that the Engineers Reserve Corps be kept intact and well-manned and that a national department of public works be established in this country. Mr. A. S. Baldwin, the retiring president, after reviewing the progress of the Society in 1919, delivered a wonderful address—"The Engineers' Trust"—on the problems facing the engineering profession as members of society. He asserted that there should be a more stern application of and compliance to the "Golden Rule." Mr. F. K. Copeland, the incoming president, outlined the proposed scope of activity for 1920. He declared that the aim of the Society should be to give to its members uplifting ideals as well as improved service. The results of the annual election of officers for the Society were announced: President, F. K. Copeland; First Vice-President, C. F. W. Felt; Second Vice-President, J. L. Hecht; Third Vice-President, Linn White; Treasurer, F. F. Fowle; Members Washington Award Commission, Albert Reichmann, E. W. Allen.

Meeting No. 1064, February 2, 1920.

This was a general meeting of the Society, there being seventy members and guests present. Dean Hayford, in his paper on "What Should Be Done to Develop the Civil Use of Airplanes," declared that the government should get behind the movement for the development of aircraft and provide funds for its promotion. Many well-equipped and carefully maintained landing fields should be provided so that the factor of safety might play a greater part in the development of the art of flying, and the government should establish airplane navigation laws and the proper agency for their enforcement. He said that improvements in the machines and their operation should be speeded up through scientific research and invention, and resultantly, progress of their kinds would be accelerated. Dean Hayford, using the records established by the air service of the postoffice department, asserted that with greater development in the airplane field, the costs of maintenance and operation could be greatly reduced. Dean Hayford is a member of the National Advisory Committee for Aeronautics. The meeting was adjourned at 9:30 p. m.

Meeting No. 1065, February 9, 1920.

This was a meeting of the Bridge and Structural Engineering Section of the Western Society. There were 79 members and guests present. A. W.

Dilling presided. Mr. Hunt, who appeared as a substitute for Mr. Carlisle P. Winslow, Director of the Forest Products Laboratory, delivered a very interesting paper on "The Relation of the Work of the Forest Products Laboratory to Engineering." The laboratory, he said, is a branch of the forest service of the United States Department of Agriculture. The purpose of the institution is to help conserve the timber supply of the United States through the judicious use of lumber supplies. Tests are conducted there to determine the relative strength and qualities of durability of the many kinds of wood found in the United States when placed under certain conditions. The laboratory, it was learned, was responsible for quite a saving in shipping space during the war. Boxes were so designed and constructed for shipping ammunition that much space in the holds of vessels was saved and the cost of making the boxes considerably reduced without incurring a loss of strength or quality. Mr. Hunt explained in details the various tests made at the laboratory as well as the system of providing service for those who have engineering wood problems to solve. This paper was illustrated with numerous lantern slides.

Meeting No. 1066, February 16, 1920.

This was a joint meeting of the Mechanical Engineering Section, Western Society of Engineers, and the Chicago Section, American Society of Mechanical Engineers. There were 60 members and guests present, Mr. A. L. Rice presiding. Mr. Richards, in his paper on "Factory Fire Protection," said, that there were four vital features necessary to the success of a modern industrial plant and that each feature demanded fire protection. They are: Fire protection necessary to protect capital, the stockholders, and others who may be financing the industry; Fire protection is necessary to establish credits; Fire protection must be had to insure continuity of output and production; and Fire protection must be provided to insure profits for at times through fire profits stop when output stops. He said that the most valuable insurance is that which has a low cost of policy and a high expense for construction of plant. Four factors besides indemnity govern the safety of a plant against fire loss, he said. They are exposure, construction, occupancy and protection and prevention. Every plant should maintain its own protection service against fire, Mr. Richards declared, and should train the employees what to do in case of fire. This paper brought out an interesting discussion, wherein new methods of prevention were discussed.

Meeting No. 1067, February 23, 1920.

This was the organization meeting of the Railway Section of the Western Society of Engineers. There were 157 members and guests present. Mr. C. F. W. Felt, chairman of the committee on organization, presided. The rules of the section were adopted, being the same as those used by other sections of the Society and it was determined to have the regular meetings of the Section the third Thursday of each month, with the exception of July and August. The nominating committee nominated the following officers, who were elected by a unanimous ballot: Chairman, C. F. W. Felt; Vice-Chairman, H. G. Clark; Director, one year, L. J. Putnam; Director, two years, A. G. Shaver; Director, three years, C. P. Palmer. Mr. Dunn, in his paper on "The Return of the Railroads to Private Control and Their Problems," reviewed the situation at the time the railroads were taken over by the government. At that time there were three reasons, he stated, that caused this revolutionary change, namely, inefficient operation, finances and labor troubles. Efficiency in operation during the war was dealt a serious blow due to the fact that many passenger trains were taken off, resulting in crowded traveling conditions. A series of unauthorized strikes seriously hampered freight service, and on some roads freight traffic was almost suspended. On the return of the railroads to their owners on March 1, Mr. Dunn stated that government control would show a loss of $854,000,000, due in part, to an inadequate increase in rates. He then discussed the provisions of the rail road bill which has recently been passed by congress, one of them being the consolidation of the railroads of the United States into a number of system under government supervision, as provided in Section 407 of the bill. In conclusion, Mr. Dunn said that this was the first constructive legislation offered the United States with regard to this problem. It was his belief that it would operate in the interests of the public and protect the transportation facilities of the nation.

Meeting No. 1068, February 28, 1920.

This meeting was held on the occasion of the presentation of the Washington Award, founded by John W. Alword, M. W. S. E., to Herbert Clark Hoover for "pre-eminent services in promoting the public welfare." Representatives and members of the local sections of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers and the American Institute of Electrical Engineers were present at this dinner. There were 537 members and guests present, the dinner being held in the Banquet Hall of the Hotel Sherman. Mr. F. K. Copeland, president of the Western Society, presided. The regular order of the program was somewhat disarranged by the late arrival of Mr. Hoover's train from the East. Mr. Hoover, speaking on the "Inter-relationship of General Industry and Food Production and Distribution," declared that a more even balance between agriculture and industry must be maintained if we do not wish chaos in this country. He said that transportation conditions must be so arranged that the producer will receive more for his raw materials at the time when they are ready for the market and that the consumer will have to pay lower prices than those prevalent today. In accepting the Washington Award, Mr. Hoover said that he accepted the tablet, not for himself but as a trustee for the thousands of engineers who have assisted him in his relief undertakings. Mr. Onward Bates, representing the American Society of Engineers, spoke on the "Engineer—A Citizen." Mr. Charles H. McDowell, for the American Institute of Mining and Metallurgical Engineers, chose as his topic "The American Mining Engineer." Mr. J. R. Bibbins, representing the American Society of Mechanical Engineers, spoke on "Service and Inspiration," while Mr. Bion J. Arnold of the American Institute of Electrical Engineers presented a paper on the "Recognition of the Engineer." Mr. C. F. Loweth, as chairman of the Washington Award Commission, made the presentation to Mr. Hoover. Extemporaneous remarks were made by Mr. John T. Richards and Frederic P. Vose. The meeting was adjourned at 1 a. m.

EDGAR S. NETHERCUT, *Secretary.*

CURRENT NEWS SECTION

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NO PANIC, SAYS FORGAN

Peak of Extreme Financial Situation Passed

Mr. Forgan's address will be published in its entirety in a later number of the *Journal.*

"There will not be a panic in the United States," said David R. Forgan, president National City Bank, at the second noon-day luncheon of the Western Society, at the Morrison Hotel, May 7.

"The crux of our present financial situation was brought on by the difficult railroad situation, culminating in a strike, which brought on an acute stage of credit expansion. However, the peak has been passed, I believe and with the application of a little common sense conservatism we will be able to demonstrate that in the United States the worst never happens."

Mr. Forgan declared that the banks of this country are approaching the limit of credit expansion allowed by the Federal Reserve Act. The Federal Reserve Banks have one-quarter of all the gold in the world as a basis for this expansion, he pointed out. Over one-half of the credits of the Federal Reserve are used in carrying government finances, such as the Liberty Loan.

Profits in 1919 were greater than ever before, he asserted, even after government taxes had been paid. The period between January 1, 1919, and May 1, 1920, witnessed the greatest stock broking and security campaign the world has ever known, although prominent Wall Street men fifteen months ago were very pessimistic over the U. S. financial situation.

Mr. Forgan said he would prefer to assume that high prices caused credit expansion rather than that expansion of credit brought about high prices.

There were 500 members of the Western Society present at this gathering. J. H. Libberton, chairman of the Luncheon Committee, presided.

The Military Affairs Committee of Engineering Council has unanimously adopted a resolution which declares that enactment of Legislation for universal military training and a military reserve is of national importance. Fourteen members, of the committee of 19, are former engineer officers of the United States Army.

ENGINEERING SOCIETIES TO HOLD NATIONAL ORGANIZATION CONFERENCE

The Joint Conference Committee of the four founder engineering societies has issued a call to engineering organizations of the United States for an organization conference to be held at Washington, D. C., June 3 and 4.

The purpose of this conference is to bring into existence a comprehensive organization of engineering societies which, it is proposed, will coordinate the welfare of the public and the engineer.

The Joint Committee has drawn up a plan of reorganization based on the following principles:

(1) Non-interference with the inter-relations with respect to technical matters and the maintenance of the autonomy, functions and operations of individual organizations.

(2) Local affiliation of existing groups of engineers to facilitate action in matters of common interest.

(3) National association of engineering organizations by means of National Council composed of representatives of local and national organizations.

(4) Financial support contributed by individual organizations on basis of membership.

(5) Form of organization which will permit expansion and development.

One hundred six national, sectional and local engineering societies and allied technical organizations have been invited to this conference. Delegates are to be chosen on the basis of one delegate for 100 to 1,000 members and one delegate for each additional thousand or fraction thereof.

The Western Society will have three representatives at this conference.

APPROVE DEPARTMENT PUBLIC WORKS

The Merchants' Association of New York has endorsed the principle of a Federal Department of Public Works, but at the same time advocates that the proposal be studied by a Congressional Committee before final action is taken.

The Association appointed a special committee consisting of J. G. White, William Loeb, Jr., Duff G. Maynard, William C. Redfield, and Henry L. Stimson to consider this matter. They recommended that in reference to Senate Bill 2232 (creating a national department of public works) that the Association "express to Congress its approval of the consolidation into a single department or bureau of related engineering and construction bureaus, but that it do not approve any bill for that purpose until such study as indicated has been made by Congress.

"In effecting such consolidation, however, the utmost care should be used to avoid detaching from existing departments bureaus which can function most effectively only when intimately associated with and controlled by such departments. The purpose sought is increased administrative efficiency. No transfer should be made unless it is entirely clear that such increased efficiency will result. The proposed transfer of the Bureau of Standards will illustrate this. That bureau is now concerned very largely with the development of improved manufacturing methods in many industries, in which field it is performing work of immense public value. The initiative for this work almost invariably comes from the Department of Commerce by reason of its constant contact and immediate relations with the manufacturing industries of the country. It is obvious, therefore, that the Bureau of Standards could not as effectively perform its work if it were transferred to another department, where its intimate contact with the Department of Commerce would be broken.

"It is, therefore, highly important that before any specific bureau be transferred to the proposed Department of Public Works a very thorough study of its functions and its logical relations be made; and that it be clearly established that the proposed transfer will be beneficial.

"The pending bill would materially alter the relations of the army engineers to public works. Your committee feels, however, that any new legislation should leave it possible for the Army Engineers to continue to be available for the construction of civil public works; this to be accomplished by details which will not interfere with their military functions."

SAFETY ENGINEERS MEET

The first conference of the Engineering Section, National Safety Council, in New York City, on April 27, emphasized the importance of engineering as a vital factor in accident prevention.

This meeting was attended by representatives of national engineering societies, universities, inspection departments of insurance companies and men in charge of accident prevention in industries.

It was agreed that every engineer should be given training in the fundamentals of safety and that the approach should be from the economic rather than from the humanitarian standpoint. It was pointed out that eventually one or two universities may develop special courses in safety engineering.

BINDING THE JOURNAL

It is the desire of many members of the Western Society to have the Journals bound into volumes at the completion of each calendar year. The Technical Section can be bound separately inasmuch as this section is paged consecutively. An index for the Technical Section only will be issued in the last number of each volume.

The News and Technical Sections are made up on separate forms so that they may be easily separated by those who wish to do so.

To hold to strict account a person through whose carelessness a fire is started is one of the greatest remedies for reducing our great annual fire loss, and this subject is being forcibly agitated by the Industrial Commission of Wisconsin. Personal liability laws for damage by fire are in effect in several cities in the country, some requiring that the careless individual pay for the cost of putting out the fire and some requiring the payment of a fine for non-compliance with an order from the Fire Warden's office to remove existing hazards within a given time. In every case these laws have not failed to reduce materially the fire loss. It is estimated that 90 per cent of our annual fire loss is preventable, and if laws to punish carelessness exist and will produce the needed result, they should certainly be strictly enforced.

The value of building contracts awarded for March in the section north of the Ohio River and east of the Missouri, is record breaking for the month, the amount being $366,415,030, according to figures compiled by The American Contractor, against a total of $216,663,000 for February and $235,848,000 for January.

MAKE RECOMMENDATIONS TO CONSTITUTIONAL CONVENTION

The Public Affairs Committee has approved and forwarded to each member of the Constitutional Convention, now in session atSpringfield, recommendations as to articles to be included in the new state constitution.

These recommendations are:

1. Local governments in Chicago should be consolidated, by legislation, subject to local referendum, including performance of county functions by city within city limits.
2. Chicago and all other municipalities should be given power to frame, adopt and amend own charter, with autonomy as to its structure.
3. Municipalities should have all powers of self-government, subject to constitution and general laws.
4. Present power of legislature to limit municipal taxation should be continued.
5. Municipalities should have full power to own and operate local public utilities.
6. The borrowing power for ordinary public purposes should be limited by constitution to a specified per cent of value of taxable property.
7. An additional limit should be established within which bonds may be established for purchase, development, constructon or extension of local income producing public untilities, provided that each of such utilities should be self-supporting, in that adequate charges for service be maintained to meet all expenses of operation and maintenance and to provide for payment on bond, principal and interest each year.
8. All municipally owned or operated public utilities should be subject to state regulation.
9. There should be a single consolidated court in Cook County with power to create own internal organization.
10. Constitution should include plan of appointment, adequately safeguarded, for selection of judges in Cook County, which will permit system for electing Chief Justice.
11. Abolish minority representation and culminative voting.
12. Apply principle of short ballot to executive offices of state and counties. Requirements that these offices be elective, be made in constitution.
13. No state supervision and control of county offices.
14. Establish in constitution that "appointment, advancement and tenure of employees of state and of all civil divisions and municipalities thereof shall be based on ascertained fitness and merit."
15. Abolish superintendent of public instruction as elective office. Make provision for creation by legislative action of some type of state system of education capable of progressive development.

    Office of county superintendents should be abolished as an independent constitutional office.
16. New constitution should be submitted to people in form of separate amendments rather than in one document for ratification or rejection.

The National Federation of Construction Industries has made public return on a referendum to its membership concerning the Federal Department of Public Works.

The two questions submitted are:

1. Shall the Federation endorse the Jones-Reavis Bill for the creation of a Federal Department of Public Works?
2. Shall the federation endorse the principle of the above?

Of the associations in the National Federation of Construction Industries 72.7 per cent approved question 1 and 100 per cent approved No. 2.

Seventy-five per cent of the individual members approved No. 1 while 92.8 per cent registered as in favor of No. 2.

This is a remarkable expression of opinion and should have great weight with the business interests of the country.

ANNUAL MEETING OF A. S. C. E IN PORTLAND

The American Society of Civil Engineers will hold its annual meeting in Portland, Ore., August 10-12.

Houston, Tex., had been chosen for the 1920 meeting place and the date set in October, but owing to several amendments arising from the questionnaire recently voted upon, it was recommended that the meeting be held earlier so that action might be secured on these amendments.

SEND APPEAL TO ENGINEERS

The Engineers' Hoover Committee, 480 Lexington Avenue, New York, has sent out the following "To the Engineers of America":

"Fellow Craftsmen:

"None of the undersigned has been active in 'politics' heretofore; nor are we now! But we believe that our country needs just one kind of a man to guide its fortunes during the next four years.

"He should be a man understanding the underlying causes of the present nation-wide unrest—the economic as well as the social causes; a man who has administered large affairs successfully, handled vast sums economically and honestly; has employed laborers with sympathy and success; one having executive experience; who has made his way up from humble beginnings and therefore understands the psychology of the man who works with his hands; one who has the courage to combat squarely, whether in the board-rooms of corporations or in the councils of ignorant or vicious 'soviets.'

"We need a man not only 'favoring' economy in the National Administration, but an avowed advocate thereof, with the knowledge gained from experience of how a budget system is prepared and also how it should *work;* in other words, a sane and tried 'efficiency expert.'

"America needs a man who has seen and knows actual conditions overseas and who can guide our international relations with firmness and sympathy, justice and honor; a man who has met face to face and understands those who lead the councils and influence the policies of European Nations, new and old; who has had not only the grace to say 'Yes,' but the courage to say 'No!' when necessary, not only to our late enemies, but to some others abroad who would take advantage of American sympathy or generosity—yes, and to some of the few here who would 'profiteer.'

"Some of us know and respect one or more of the men who are seeking in an honorable way to secure the presidential nomination, and others who are also favorably thought of; *but has anyone of them the first-hand knowledge of our National and International problems that are in the undisputed possession of Herbert Hoover?* We think not!

"We believe it is possible that he can be nominated, even without a political machine behind him; that the American people can constitute themselves a 'Committee of the Whole' whose choice will be triumphant, *provided the 'vox populi' can be made audible!*

"How can this be done? By bringing it about that the people shall not only speak out what we believe is in their hearts but that their voice shall be *heard.*

"We are members of one or another of the great Engineering Societies of America, but we have neither asked nor do we expect these organizations to act as *such.* But if each of you, to whom this letter is sent, will constitute himself a committee of one, each in his own locality, to spread the well-known facts of Herbert Hoover's career, personality and attainments and *to bring to the delegates of your own State the knowledge of your neighbors' demand* that he shall be the nominee, this result will surely be attained. No one knows better than the political leaders of all parties that if nominated *he is sure to be elected.*

"Will you help to bring this about?

"If anyone wishes information or advice as to ways and means he may write to his State Hoover Committee, as listed on the last page, or to The Engineers' Hoover Committee, 480 Lexington Avenue, New York.

"ALBERT R. LEDOUX, New York
"CHARLES F. RAND, New York
"HOWARD E. COFFIN, Michigan
"J. VIPOND DAVIES, New York
"CHARLES T. MAIN, Massachusetts
"HUNTER MCDONALD, Tennessee
"B. B. THAYER, New York
"J. G. WHITE, New York"

The address of the Illinois Engineers' Hoover Committee is Robert Stevenson, Jr., c-o John Burnham & Co., La Salle & Monroe Sts., Chicago.

Frank H. Cenfield, Assoc. W. S. E., efficiency engineer, was acting mayor of the city during the recent absence of Mayor Thompson and other city officials.

Representative A. P. Nelson of Wisconsin, on March 19, in the House of Representatives made a plea for further development of the great Middle West, declaring the opening of a Great Lakes-St. Lawrence-to-the-sea waterway was the key to the solution of the transportation problem and would help solve the fuel and power crisis of the eastern seaboard.

Quoting from the latest available statistics, Mr. Nelson said that the total value of products produced in the territory adjacent to the Great Lakes was as follows:

Agricultural implements produced, $133,377,000.

Products of automobile industry, $546,454,000.

Value of manufactures, $8,806,960,000.

Meat packing products, $1,138,503,000.

Mineral products, $605,925,000.

Rubber goods (exclusive of belting, hose, boots and shoes), $117,972,000.

Value of dairy products, $242,190,000.

The U. S. Civil Service Commission announces an open competitive examination, June 22, for ordnance research engineer to fill positions paying from $4,000 to $5,000 a year.

The duties of the position require a highly trained engineer experienced in machine and forge shop and especially the working of copper alloys. His services will be used in the design and development of ammunition.

Arison, Goodwin & Knapp have organized as industrial engineers, with offices at 327 S. La Salle Street.

Col. E. E. Arison was formerly vice-president of the Emerson Co. and has taken a prominent part in the operation of industrial plants both as a civilian engineer and as an officer in the U. S. Army.

L. Reeves Goodwin and L. G. Knapp are former associates of Col. Arison and were associated with him in the Emerson Co.

Esther M. Jack, city engineer of Williston, N. D., has been elected president of the North Dakota Society of Engineers.

HOOVER COMING TO FRONT

The popularity of Herbert Hoover, in his own profession, is coming strongly to the front in his campaign for the Republican nomination for President in Chicago in June.

Thomas A. Edison recently declared himself for Hoover, saying: "I am for Hoover for President. Engineers are a good proposition for the presidency. . . . Hoover's record is his strength. There are many promises made by presidential candidates that are soon forgotten when they reach the White House.

"Hoover will carry through his program without interference or there will be trouble."

An Engineering Branch of the Hoover Republican Club of Illinois has been formed with the following members: F. K. Copeland, chairman, C. F. Loweth, C. L. Strobel, J. W. Alvord, C. B. Burdick, A. S. Baldwin, C. F. W. Felt, W. H. Finley and Isham Randolph.

There is a great deal of strong Hoover sentiment about Chicago and the engineers' group is only one of many centers of activity.

Griffenhagen and Associates, Ltd., have taken over the Industrial Engineering Department of Arthur Young & Co., certified public accountants. Offices will be located at 116 S. Michigan Avenue.

Those interested in this new enterprise are: E. O. Griffenhagen, M. W. S. E., F. W. Howard, F. G. Heuchling, R. E. Goodell, W. G. Bailey, R. S. Holden, P. H. Meyers, Fred Telford and R. O. Beckman.

Forty-four men, well known in science and industry, have been named as a committee in charge of the Decennial Celebration of the Forest Products Laboratory, Madison, Wisconsin. July 15 and 16 are the tentative dates set for this occasion.

BUILDING OPERATIONS IN 1919

Reports received by the United States Geological Survey, from building officials of 114 of the larger cities in the country show that building operations in 1919 greatly exceeded those in 1918, both in number and cost. The number of permits issued or buildings erected in these 114 cities in 1919 was 309,551, as compared with 173,635 in 1918, an increase of 78 per cent. The cost of the operations in 1919 was $1,130,817,591 as compared with $369,252,315 in 1918, an increase of 206 per cent. If the operations in the remaining cities from which the Geological Survey usually receives statistics of building operations show a proportionate increase, the number of permits issued or buildings erected in 1919 was about 377,000, which would cost about $1,300,000,000, so that the record for 1919 was the highest yet reached in the building industries in these cities in both the number and the cost of operations.

The second annual convention and exhibit of the American Steel Treaters' Society of Chicago will be combined this year with the convention of the Steel Treating Research Society of Detroit and will be held at the Commercial Museum, Philadelphia, September 14 to 18.

Exhibit boths may be engaged by communicating with the Department of Exhibits, American Steel Treaters' Society, 208 North Wabash Avenue, Chicago.

The Railway Executive's Association has placed before the Interstate Commerce Commission data they have assembled on probable operating expenses of railroads for year beginning Sept. 1, 1920. It calls for loans of $500,000,000 in addition to the $300,000,000 revolving fund provided by the railroad law and a 28 per cent increase in freight rates as a basis for putting the country's railroads on their feet. The Railroad Labor Board has asked Congress for immediate appropriation of $450,000 to defray their expenses.

F. E. Brown, M. W. S. E., is associated with Stanley and Scheibel, architects, of Youngstown, Ohio.

JOURNAL
OF THE
WESTERN SOCIETY
OF
ENGINEERS

"To promote and advance the science and art of engineering."

MILD CONSERVATISM

"For plain living and high thinking, we have substituted wasting and bickering; we enjoy high living while we grumble at the high cost of living," said R. C. Leffingwell, formerly Assistant Secretary of the Treasury, in a scathing arraignment of the reaction and waste of the American public, in an address before the Academy of Political Science at New York.

"Since Armistice Day," he continued, "we have failed to restore peace conditions in Europe or America, unsound economic ideas have prevailed and the effort is being made first here and then there to improve the condition of some of the people at the expense of all the people."

Instead of telling people prices are high because of waste, he said, prices are fixed so that people may buy more and pay less.

"We must get together, stop bickering and face the critical situation which confronts us as we should a foreign war. We must have a national budget with teeth in it."

David R. Forgan expressed the same sentiment at the noon-day luncheon of the Society when he said: "We should act with the *usual* American common sense. If you will only preach to your companies and to everybody that this is a time for a little common sense conservatism. By all of us preaching a mild conservatism, not pessimism, we will prove once more that in the United States of America the worst never happens."

Cannot engineers be the leaders in this movement for MILD CONSERVATISM?

Reorganization of executive departments of the government by a joint committee as provided in Smoot-Reavis resolution passed the Senate May 10th. The joint committee is to make a study of existing conditions and recommend a plan for reorganization. This legislation was introduced with the approval and on the recommendation of the National Public Works Department Association. Senators Smoot and Underwood made speeches favoring the legislation. It is expected to pass the House shortly.

The Interstate Commerce Committee has ordered a favorable report on Senator Cummins' amendment to Transportation Act, designed to relieve the car shortage situation and otherwise aid the railroads. Senator Poindexter's anti-strike bill, designed to prevent tieing up of interstate transportation on railroads, was reported to the Whole Committee.

War Labor Board is to be absorbed by the Council of National Defense, and the U. S. Housing Corporation will pass out of existence June 30, 1920.

Trustees of the Chicago Sanitary District have authorized the filling up of "Bubbly Creek," which will result in the extension of 39th Street through the stockyards district to form a highway from the lake to the forest preserve. They also authorized the construction of a bridge over the Canal at California Ave., at a cost of $600,000.

Work on the improvements will begin in three months.

Frederich G. Cottrell has been named director of Bureau of Mines to succeed Van H. Manning, resigned.

The Ordnance Department, U. S. A., has housing projects for sale at Seven-Pines and Penniman, Va.

EMPLOYMENT SERVICE

NO CHARGE is made for opportunities announced in this section of the Journal.

ANNOUNCEMENTS must not be more than sixty-five words in length and will not be inserted more than twice during a period of two months, during which time all records will remain in the active files. All correspondence will be treated confidentially.

APPLICANTS for situations, not members of the W. S. E., must have card of introduction from a member of the Society.

ALL REPLIES should be addressed to the key number indicated, in care of Employment Bureau, Western Society of Engineers, 1735 *Monadnock Block, Chicago.*

SITUATIONS WANTED

B-450: BUILDING STRUCTURAL Engineer, Illinois State license. Civil graduate. 30; family; American. 4 years' clerical work; 7 years' engineering, concrete, steel and timber design; industrial buildings; warehouses; railway engine terminal layouts and buildings. Last 1¾ years in charge of squad. Some experience in bridge work. Salary $3,600 in engineering or allied work. Arrange interview.

B-451: ELECTRICAL ENGINEER with large manufacturer of electrical freight and passenger elevators desires a position as sales engineer. Have had excellent engineering education and broad practical experience with railway signals, remote electric control, industrial application of A. C. and D. C. motors and controllers and expert knowledge of electric elevator problems. Age 31. Excellent references.

B-452: YOUNG MAN, 23, WANTS work on construction projects, surveying, bridges, etc., out of town if possible. Have no experience. Attending school next term.

B-453: GRADUATE C. E. 11 years' experience heavy masonry and steel construction, railways, power plants. One year chief engineer oil company in Mexico. Want Chicago connection as sales or resident engineer, superintendent or estimator. Min. salary, $300.

B-454: GRADUATE C. E. AGE 28. Single. 2½ years' experience in bridge dept. of western railroad and at present employed by bridge company; will consider offer where his experience will be of value.

B-455: POSITION WANTED IN Middle West, preferably with some architect or building surveyor of repute, as sanitary engineer competent to supervise building erection from start to finish and also to take charge of drafting room. American, 40, have had foreign experience in sanitation; references. Former Assoc. Member A. S. C. E.

B-456: GRADUATE C. E. WITHout building construction experience, wants opportunity to start in outside building work. 6 months' experience with cost keeping systems; 3 months on heavy construction.

B-457: YOUNG GRAD. MECH. eng.; agreeable personality, initiative and sales ability is seeking sales engineering position or one leading thereto. Four years experience designer, engineer, sales engineer in heat treating equipment and power plant work. Present sales engineer truck axles.

B-458. GRAD. MECH. ENGR., 10 years experience machine design,

detail and construction work; would consider change. Age 34, married, best references.

B-459: YALE SHEFFIELD GRADuate B. S. degree in C. E., at present employed, will be open for propositions about June 1. Experience asst. surveyor; Alaskan Boundary, engineer; Chicago Tunnel, instrument man, chief of party; designer, estimator, and engineer various construction projects. Best references. What have you to offer?

B-460: C. E. EXPERIENCED IN concrete and steel and railroad terminal construction, valuation work. Now in charge of inventory and appraisal for government department, desires position in Chicago. Some experience in raw material, purchase and production work.

B-461: MECH. AND SALES ENgineer wants sales agency for steel or malleable iron in mechanical line. Experienced as sales engr., designer, inspector, shop supt. and office manager. Knows R. R. and general manufacturing trade. Has pleasing personality, good executive and not afraid of hard work.

SITUATIONS AVAILABLE.

A-50: DRAFTSMEN AND DEsigners wanted; preferably single man. Salary $250. Location, Ontario, Canada.

A-51: PRACTICAL COMMON sense builder, able to take off quantities and price same. Engineer and estimator preferred.

A-52: SALESMAN ESTIMATOR for general machine shop work, with large construction company in Pennsylvania.

A-53: WANTED—STRUCTURAL detailers and checkers experienced on structures for coal or ore handling machinery. Communicate directly with Allen and Garcia Co., 955 McCormick Bldg., Chicago.

A-54: TWO VACANCIES IN structural valuation work. Must be able to compute and price birdges, trestles and culverts based on plans and field notes. Work in Chicago office. Salary $160 and $170. Prospects for increases.

A-55: WANTED—ONE CONveyor man, not necessarily designer; one foundry draftsman; one young man with architectural experience. Must be able to make plat plants.

A local Washington, D. C., newspaper carried the following classified advertisement recently:

"Army officer wishes work in spare time; graduate engineer; four years' experience in building and general construction; do anything from pushing a wheelbarrow to running for president."

Aerial photograph maps of the Panama Canal Zone have been issued. They may be obtained on application to the War Department.

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Proceedings of the Joint Engineering Societies' Dinner
April 19, 1920

MR. A. S. BALDWIN,
Past President, Western Society of Engineers.
Presiding.

THIS meeting in Chicago of the governing boards of the four great engineering societies of this country, now spoken of collectively as the Founder Societies, constitutes, as stated on the invitation to this dinner, a notable occasion and one fraught with interest to the engineering profession.

The societies here meeting are aptly called the Founder Societies, not only on account of the association brought about through united engineering societies, but on account of the fact that they constitute the foundation upon which the engineering societies of this country have been erected and from which many other societies relating to engineering and kindred pursuits have been differentiated. A recent investigation disclosed over twenty such associations in this city alone. The organization and development of these societies is indicative of the evolution of the profession of engineering in modern times.

The oldest of them, the American Society of Civil Engineers, was founded in 1852, coincident with the beginning of canal and railroad work that was taking place in this rapidly developing country. As railroads opened up the country, exploitation of mines and metallurgy brought about the organization in 1871 of the American Institute of Mining and Metallurgical Engineers.

In natural sequence in proportion to its relative growth in importance came the American Society of Mechanical Engineers in 1880.

Finally, with the growth of electrical development, came in 1884 the American Institute of Electrical Engineers.

Our city of Chicago was not backward in these matters, and while but a small place in 1869 it witnessed the organization of the Western Society of Engineers, among the oldest in the country.

It is an interesting phase in the development of society, religion, the professions, etc., that in their early growth the tendency seems to be to differentiate into many groups or cults, each new advance or idea seeming to its discoverers or proponents to demand an individual expression in which its followers can pursue their studies, their own methods or principles in their own particular way. Thus were formed clubs and associations and political parties, numerous denominations in religion and a vast number of societies in the great professions. As government advances the advantages of concerted action become more apparent and men begin to realize that in union there is strength, and individual states are united into great unions, the denominations begin to come together and societies to merge.

This meeting together of the governing officers of these great societies is an expression of that tendency. It is indicative of the fact that these great societies are abreast of the times, that they will gain for the profession the power and prestige that comes from co-ordinated effort on a large scale, and we of the Western Society, a large percentage of whom are identified with one or more of the Founder Societies, we who have for some time so earnestly striven for co-ordination of effort among all branches of the profession in this city, feel complimented that you should have accepted our invitation to make this your point of meeting and are glad to extend to you the right hand of fellowship and welcome, with the hope that as the years roll by, more and more you may find this great western center a convenient and suitable place of meeting, assured that you will always receive a hearty welcome.

The good old state of Illinois has furnished many sons to fight the battles of the Union—some in the executive halls of our government, some on the bloody fields of war, and some to lead the forces of advancing civilization in overcoming the waste places of the land and making fertile soil where barren desert had prevailed.

"Peace hath her victories no less renowned than war," and the man who has served this government almost from boyhood, who through the science of irrigation has brought desert land into cultivation and usefulness, who has acted as Consulting Engineer on the greatest artificial waterway that has ever been built and has been called to Russia by its government as consultant in irrigation work, who has been for years Chief Engineer and Director of the Reclamation Service of this country, may well be rated as a worthy son of his state and country, worthy of the high honor that has been conferred upon him in his election to the Presidency of the oldest of the Founder Societies—I have the pleasure of introducing Mr. Arthur Powell Davis, President of the American Society of Civil Engineers.

ARTHUR P. DAVIS,

President, American Society of Civil Engineers.

I AM sure that the American Society of Civil Engineers is glad to meet in this great thriving, busy metropolis of the Middle West, glad to be with you, and glad to get some of the virility that we are bound to imbibe in mixing with the people of this forward-going city. I remember well the days when the outlook of Chicago was not optimistic, when that great fire was raging that reduced this city to ashes; but, in the long run, I believe it turned out to its benefit, for it led to a rapid, wonderful rebuilding of a far better and greater city.

At that time there was published in this city a juvenile periodical which gave me an immense amount of pleasure. I wonder if any of the rest of you ever heard of it. It was called the "Little Corporal." My mother was a contributor to the "Little Corporal," and, measured by the standards of those days, for such contributions, they owed her quite a little bill for contributions at the time of the fire, and she wrote to the "Little Corporal" that though people were taking subscriptions for the relief of the sufferers in Chicago, and she was unable to subscribe, she would be glad to donate her bill that was owing to her, to the benefit of the "Little Corporal."

A few months later we moved from the State of Illinois to the State of Kansas, just in time to have our first crop eaten up by grasshoppers. I was a farmer boy. We had been doing without the "Little Corporal" for financial reasons, so when the grasshoppers attacked us we wrote to the publishers, we children—our mother knew nothing about it—and reminded them of the contribution our mother had made to them, and asked them if they would not send us the "Little Corporal" in return for that contribution. We received a very nice letter from Alfred L. Sewell saying that we were on the subscription list of the "Little Corporal" as long as it was published, and there we stayed, and we children always remembered and appreciated that.

A great many recollections of Central Illinois, where I was born, are very dear to me, but there has been no pleasure so great as coming back to the old place and to the old State and seeing the vast changes that have occurred. They had never discovered coal in Illinois when I left the State. Think of the change in that time and the wonderful development in this city and in the State throughout, making the great empire State that it is, the third State in population and the first State in enterprise of the whole United States.

The Four Founder Societies that have been described historically, and incidentally the Chairman in describing the formation of these societies took away the only part of the speech I had made up, but I wish to refer to that as the interesting development.

The American Society of Civil Engineers when organized was designed to include all engineers, and as the profession of engineering expanded and gave rise to the different branches as they developed, of Mining, of Mechanical, and Electrical Engineers, these other societies were formed to meet the needs of the people specializing in those lines, and the old parent society did not expand as the profession did, did not expand as civilization did, but it led to the growth of these other societies.

In addition to the Four Founder Societies there are two later ones that have specialized in lines that are strictly civil engineering, the American Railway Engineering Association and the American Society for Testing Materials, specializing in the specification of standards of various kinds that are needed as a co-ordination and consolidation of the efforts of engineers to prevent the scattering of their efforts and duplication of work and of all kinds of research.

A great development, a great change, has come over the minds of men in the last five years. Things have happened in that five years that none of us could have predicted, even the man who could prophesy a great world war, would never have predicted the great changes that that war has brought, the changes in men's method of thought, in standards, and in men's feeling toward each other, and especially toward others of other nations.

To meet those conditions any society, to keep abreast of the times and do what it should to fulfill its functions, must also expand and broaden its field and its activities and the method by which that is to be done is the subject that is under consideration here by this Society.

A few years ago Andrew Carnegie gave a large bequest for the construction of a United Engineering Building in the city of New York, the funds for which he offered to the four societies that are now called the Four Founder Societies. Three of them accepted and built the building and moved into it. The fourth society, the American Society of Civil Engineers, clinging to their former policy of exclusiveness, did not agree with me that we should go into it. I voted for it but the majority voted against the proposition. Sometime later they saw, acknowledged, and corrected their error. They moved into the building and are now one of the Four Founder Societies, and are admitting others to share, of course, in that benefit.

Now the question is: "Is the American Society of Civil Engineers going to repeat its mistake on the proposition now up for the unification of the engineers of the country under the guidance of the Four Founder Societies; will the American Society of Civil Engineers, the oldest and probably, in the estimation of many of its members, the most aristocratic of the Four Founders Societies, stay out, let the other societies blaze the way, go in and do the hard work, show that it can be done, and then come trailing after and acknowledge its error and make up the best it can for not joining?"

We have submitted a series of questions to the membership. Those questions, some of them, went to the fundamentals, and some of them went to methods, and I am glad to say that the recent canvass of those votes showed that our membership, by a three-fourths majority, favors the principles put forth for the unification of the efforts of the American Engineers, so that we will have eventually a unified engineering profession, represented by a definite line of authority similar to the American Bar Association and the American Medical Association, which can, without question, be said and acknowledged to speak for the profession as a whole. Such an association is badly needed, not only for the benefit and welfare of engineers themselves, but more for the benefit and welfare of the engineering profession, and the rest of the world.

A great deal has been done by worthy, prominent members, eminent engineers, to guide the public mind along engineering lines in the past. It has been my privilege, as the Chairman has said, to be connected in a somewhat intimate fashion with the great problem of the American Canal across the Isthmus. That was first proposed across the Isthmus of Nicaragua. A company had made a survey there, had attempted to build it with private capital, had failed, and had carried on a long and active propaganda to unload its scheme upon the United States. I think not less than nine-tenths of the people of the United States believed in an Isthmian Canal, believed that was the place to build it, and actively favored legislation committing the United States to the Nicaraguan Canal.

But wiser counsel prevailed and a board was organized to investigate that canal, and a small appropriation made to pay the expenses of this board in making such an investigation. That appropriation was utterly inadequate, and this small body of devoted engineers, instead of simply doing what their appropriation would pay for, transacted all that business and assumed all that heavy responsibility without compensation, spending all the money that was appropriated to make investigations and carry out the work for which they were appointed, without compensation, depending upon Congress later to appropriate for their valuable services, which, I am glad to say, Congress did.

The Board, headed by Col. Ludlow, and known as the Ludlow Commission, having also as members Admiral Endicott, and Alfred Noble, represented the army, the navy and the civilian engineering branches. They reported that the information and data were totally inadequate, and their appropriation insufficient to complete them. They met with the bitterest kind of denunciation from the advocates of that canal, and I think a large amount of incredulity on the part, not only of the people at large, but of the engineering profession itself. But they put such logic behind their report and backed it up with such a remarkable defence before Congressional committees that they finally prevailed, and a larger appropriation was made, and a new commission formed to investigate that problem. With a much larger appropriation this new board found it was inadequate to solve the problem, but made an estimate totally out of proportion to the one that had been widely disseminated and widely believed, and showed that the problem was far greater than had ever been anticipated. That was followed by a third investigation, with a very much larger appropriation and a larger board to investigate all Isthmian routes. That again was denounced as merely a means of postponing the construction of the Isthmian Canal and attributed to railroad influence.

Not being dismayed by that criticism, a board was appointed which made the investigation and found that many of the problems had not been solved in connection with the Nicaraguan Canal and that they were very serious and difficult. Finally the board recommended in favor of the Panama Canal, a name that had been anathema on the tongues of all mankind for years before, but with courage and conviction and knowledge of what they were about, the board favored the Panama Canal.

I think there is no living engineer who is well acquainted with both routes and has been over them thoroughly but is convinced that the great difficulties met with in the Panama Canal would have been vastly increased in the Nicaragua Canal, and that the courage of those three engineers, General Ludlow, Admiral Endicott and Alfred Noble, two of them ex-Presidents of our Society, saved this country from a disgrace similar to that of France when she failed in the construction of the Panama Canal. There is an instance of what men, single handed, can do. If they could have been backed up by a united engineering profession, if they had had behind them such a federation of existing societies, think of how much easier it would have been for those three men. We do not ask for any individual memberships in this new organization, but simply that the engineering societies of the country get together and form a federation that can speak with authority for the engineering profession of the United States, and where the public mind is chasing a fallacy that involves engineering questions, that the fallacy can be corrected and we will be saved from what we so narrowly escaped in the Isthmian Canal.

On behalf of the American Society of Civil Engineers I thank you most profoundly for the honor you have conferred upon us through the invitation to our Board of Direction to meet with you here. We will be very glad to join in the Joint Meeting tomorrow, and thank you very much for the honor of this occasion.

Mr. Baldwin: Lord Byron said on one occasion, "Men are the sport of circumstances, when those circumstances seem the sport of man." This is one statement of the age old problem of the ambitious man. To what extent do we mold our fate or to what extent are we the victims of environment? Shall we admit we are the sport of circumstances and allow ourselves to drift with the tide, or shall we resolutely meet and conquer circumstances?

These thoughts have frequently come to me in considering the lives of our early soldiers, statesmen and jurists, who functioned in bringing freedom to our country and establishing a Government and a Constitution. Our

> "Washington, Jefferson, Henry, and such,
> Who sinned with a great transgression,
> With their old-fashioned notions of freedom and right,
> And their hatred of wrong and oppression."

Was it the extraordinary conditions that made the men, or was it the extraordinary ability and character of the men that made the conditions? It seems to me the answer is clear. Circumstances must enter very largely into the moulding of the man, but the man, primarily and essentially, the man must be there to be made.

When the Master Sculptor has conceived in his mind a great work of art and has formed and fashioned it in his imagination, the next step is to find the block of marble from which his dream can be converted into reality, and so he goes from quarry to quarry examining the different strata and setting their fineness and their fitness until finally he exclaims, "There is my block!" And that block is finally converted into the perfect image that delights the soul of his admirers.

Some five years ago there came into this world the desperate need of a service. War, gaunt famine and horrid cruelty stalked rampant in some of the fairest lands of earth and a *man* was needed. One who had administrative ability and diplomacy and courage, and above all one who was willing to sacrifice himself, and I can imagine that the Master of men as He surveyed His quarries and His storehouses of material, finally came to one of whom He could say, "There is the man!" And that man was Herbert Hoover (applause), who was to have been with us here tonight, but who was unfortunately detained, but whom we are just as glad to honor in his absence as we would have been in his presence. As a result of that choice that service from our country was most admirably administered; famished women were fed and revived and could furnish life giving streams of nourishment to their little infants, the lives of thousands upon thousands of children were saved; food and clothing and a roof of shelter were given to the old, the poor, the downtrodden and forsaken, and that was not all, for through that service and the skillful manner in which the service was administered a bond of fellowship was formed that will live, and the hearts of many thousands of people will turn, aye, fondly turn, for generations yet to come, with love and faith to this country, confident that there is a strong arm to defend the weak, that the rights of the smaller nations will be protected, and that in spite of the wrangle of demagogs, the selfishness of partisan politics and the evil designs of those who would breed strife instead of friendship and comity, some day a league or alliance between nations will come that will prevent the ghastly suffering that has distressed the whole world, and the work of the Commission for Relief in Belgium and the man who administered it will have done a noble part in bringing that about.

Mr. Hoover not being able to be present, is worthily represented by a Director of the American Institute of Mining and Metallurgical Engineers, Mr. Arthur Thatcher, Director of the Mining Department of the New Jersey Zinc Co. of St. Louis. I have the pleasure of introducing to you Mr. Arthur Thatcher.

ARTHUR THATCHER,

Director, American Institute of Mining and Metallurgical Engineers.

THE events of the past few years have been so important and and critical that it is well for us to pause and see where we stand. The great war involving as it did practically the whole world, directly or indirectly, the tremendous spectacular part of it, and the material effects have rather appalled us. The loss of life and money was tremendous. The loss of life can never be replaced, taking as it did our best and strongest citizens of the world, but when we turn to it for numbers it has not depopulated the world. We have not gone back. The losses, I believe, are figured now as somewhere about eleven or twelve million in the Army, perhaps as many more for the civilians or something over twenty million in all. The figure is tremendous, but when we remember that the world has 1,700,000,000 inhabitants, supposed to be increasing in population perhaps more than one per cent per year, we see that in the five years of the war the loss of life has only been what the natural increase would have been, perhaps, for one or two years.

The question of the financial loss is great, and brings us into the billions, which again are appalling. The present estimates put the direct war losses at about $150,000,000,000, with probably indirect losses, including the losses for loss of life, of as much more, making a total between three and four hundred billions of dollars. This is a large percentage, although not a majority percentage, of the wealth of the world, but we make a mistake when we take simply the wealth of the world, for it has been estimated that the whole wealth of the world would not support the population more than three or four years, and the war losses covering a period of some five years were probably not much greater than the productivity of the world for one year. We note these things in seeing reconstruction going on, which has been greater than most imagine, more rapid, and this loss can be made up.

In considering our losses we must remember that in the past the losses in such a war would have been far greater than in this present war, due largely to the fact that we were enabled, with ambulances, trains and appliances and with surgeons, hospitals and Red Cross, to mitigate the loss of life.

Another great fact was that in the past the countries were devastated by disease and famine, and passed out of existence, like Nineveh and Babylon. In this war, fortunately, and for which this country can take pride, through the work of Herbert Hoover, we were able to minimize this and the world was saved from famine and disease.

The question, though, of the great war was not so much the material part or the spectacular part as it was a question of thought, the mentality, the thought back of the war. It was the great fight against autocracy. Autocracy is another name for slavery. Brutal slavery had passed away in the civilized nations, but it was bringing it back with autocracy, and the world rose against this.

Taking the mental part of it the war was a battle. We won it, but it is only one of the milestones along the course of civilization. The great work is to be taken up and carried on from this point. We see the world stricken, then recovering as from an operation or a disease, successful, it is true, but still weak and in the convalescent stage. We see then that they are weak, anxious to get a start, but are restless and tossing from side to side, and grabbing at every patent medicine or get-rich-quick scheme or any cure-all. Our great danger lies in this mental activity and bringing up these "isms," or whatever they wish to call them, Reds, I. W. W. or anything else. They are the false doctrines. It is time for those who wish to think and those who are capable of doing it, to study and not accept these patent medicines and things which are centuries old, have been tried out two thousand years ago, many of them, and proved unsound and fallacious. You see this in most every way. They grab at profit-sharing—unsound at the bottom and cannot succeed. It may be a temporary remedy. Many of these may get us over some troubles at the present time, just as the doctor gives you morphine or something else to ease the pain, but if carried out as though they were the ultimate cure-all they will bring us to destruction the same as the morphine would.

We have had many lessons. We are having many more now. Take the strike question. A few years ago we would have said the striker is justified and the poor laboring man must have some redress. It is his only weapon we would have said. That is the same argument that was used thousands of years ago when brute force was the only weapon they were supposed to have. We have advanced in civilization. We say it is not necessary to kill and maim to get our rights. We have advanced in the last few years until I believe that we all recognize that the strike is unjustifiable in the case of the police or army. We are advancing another step, and now it is being put that it is unjustifiable in cases where it brings great distress to a large number. What is a democracy? What do we stand for? If it is a crime when it is a large number, is it not a crime when it is the individual? Is it not, in this country, the opportunity for the individual? Is he not entitled to his rights, protected in such? The demagog argument that the poor laborers will suffer is a fallacy. No organization was ever built up to large numbers unless the workmen were properly treated, both as to conditions and wages. They at least got reasonable, fair wages or they did not draw together their thousands or tens of thousands of workmen. Will the management have a brain-storm and suddenly try to cut their wages twenty-five per cent? Impossible! They may not advance, not give them the adequate advance, or may cut wages to a certain extent. The workingman is not thrown out of work, pitched out as a starvling then. He is not put in a position that he is actually starving. The cut is small. What will happen? The better workmen will drift away. There are too many competitive works which would be only too glad to take from any corporation or any body of men their better workmen and take care of them. The industry would start to decline and go down. Do you believe that the heads of that industry would permit that?

I have been calling your attention to one or two of these points to let us all get together and think. There is nobody in the world, no people, with a better training than the engineer for these problems. He is accustomed to weighing facts, not only of science but of material and humanity, and it is the engineer from his very training and experience that should be willing to take up these problems and properly carry them out. Many have been surprised at Mr. Hoover and his career. Many have been surprised that he was able to write articles and make speeches on economic questions. Should he not be able to? His life has been devoted to building up towns. Consider his career in Australia, in China, in Burma, in South Africa, and perhaps more than all the rest in the Urals of Russia, where he built up industries with thousands of people, where he was the head, where it was a question of government, where it was the question of proper living conditions, sewage, schools, and even churches. He must make a living condition. The very questions of political economy were what the mining engineer had to meet. Therefore when he turns his attention to the larger government of this country or the questions involved, he is fitted, his training has made him fit for that position.

There is only one thing in all this life, in all this bringing up of civilization, and that is the question of right, the Golden Rule,—love, although that sounds sentimental to the business man, but it is the square deal, it is the right. We must seek that right and then follow it. We do not make laws, we discover them, we do not fashion something that is going to get us out of our troubles quickly; we simply study and discover what the law is and that law will never stand, no principle will ever live, unless it is founded on righteousness.

Mr. Baldwin: We hear a great deal about the power of the press. I wonder sometimes if Engineers give sufficient thought to the power, influence and helpfulness, from a professional standpoint, of the great technical journals which have developed so amazingly during the past two or three decades in this country? From the ranks of the editors of those journals have come some of the most constructive thinkers along economical lines that the country has produced.

The American Society of Mechanical Engineers has shown the thoughtfulness of its members and their recognition of ability in the election to its Presidency of one of these editors who for twenty years was associated with one of the most prominent professional journals, during ten of which he was editor-in-chief. That the years that have passed since Mr. Miller severed his relationship with that journal have found him the manager of a great group of factories, a Major of Ordnance in the service of his country, and ever prominently and usefully identified with engineering affairs of his society as well as of others in the Founder group but the more bespeak the wisdom of his selection. I have the pleasure of introducing Mr. Frederick J. Miller, the President of the American Society of Mechanical Engineers.

FRED J. MILLER,

President, American Society of Mechanical Engineers.

AN individual can attain age simply by continuing to exist, but no society can do that. A society or an organization of any kind, not subsidized, cannot attain the age that I have attained unless it does something that is creditable and worth while, and we all know that the Western Society of Engineers has much more to its credit than mere existence since its foundation.

The American Society of Mechanical Engineers, which I have the honor to represent, has always shown a considerable spirit of progress and of co-operation. I think its members generally recognize that the engineer is by tradition and training an innovator. His work renders valuable that which before perhaps had no value, and, on the other hand, sometimes renders of no value that which previously had value. Those are necessary consequences of the engineer's work. The engineer, this being the case, should, I think, be willing to take his own medicine, and societies, no matter how old they may become, should retain that attribute of youth which enables us to consider and to study and perchance to adopt new ideas.

Our society immediately following the appointment by the Civil Engineers of their committee to consider the problems now before the engineering societies concerning co-operation, appointed a committee which we called the "Aims and Organization Committee." That committee, after considerable conscientious and hard work, submitted a report advocating considerable changes in our society, particularly along the lines of the Democratization of the administrative features of the society, and strongly recommended co-operation of our society with other engineering societies. None of us can be certain as to what will happen in the future, but I think it is easy to predict that the time will come when there will be in Chicago, by the growth of engineering and the interest of engineering in this neighborhood, a headquarters building of engineering somewhat similar to the United Engineering Building that we have in New York. In that building will probably be housed all the engineering interests of this section, and I believe it is easy to perceive or to predict that it will eventually house branch offices of the principal engineering societies of the country, and, if we allow our imagination to go a little further, we might imagine that by the development which may take place in the future that those branch offices may, as sometimes happens in other organizations, become really the principal offices of those associations.

It is generally expected that in our joint activities we shall attempt to deal more than ever before, and especially more effectively than ever before, with matters of public concern. Our relation to those problems will necessarily be of a two-fold nature, for first, we are citizens of a great country, with the duties and responsibilities that pertain to that citizenship. After that we are engineers, with duties and responsibilities, not only to ourselves and those dependent upon us, but to the high and honorable profession to which we belong.

With respect to all purely engineering matters, engineers can and will speak with the authority of experts, but all public questions connected with engineering will have, or nearly all will have, an aspect of public policy, and I think we will do well to remember, in discussing these matters, that we will do best to confine ourselves to the purely technical side of those questions, for we must remember that where a question has a public aspect, other citizens of the United States, not engineers, will have as much right, and will be as much expected to hold and to express views upon those matters as we do. Our testimony as engineers will have more effect if we carefully refrain from giving the impression that we assume any extraordinary or special ability regarding the public side of these questions that may come before us. We can be, in a sense, expert witnesses, testifying for what we believe to be right, but with all the well understood limitations of the expert witness, and our influence on the expert or the technical side of these questions will be the greater in proportion as we confine ourselves to that side of the matter. It is obvious that our own members will have varied views regarding the public questions that arise, and for that reason I think we should also be very cautious about affiliations of our engineering societies with other organizations not composed of engineers, nor having engineering objects, because if we attempt to commit our members to questions not dealing strictly with engineering matters, then our own members will have widely varying views on these matters. By attempting to commit our members to them we shall, I fear, promote dissension and possibly disintegration. I think it is well to bear that in mind and be cautious about such affiliations and joint actions.

Finally, if we are to serve the public, the public must know much more about the engineers' work than it has been able to discover or to know heretofore, and that means publicity, a thing which the engineers have not cultivated as they should, and which I think needs a great deal more attention than has been given it. Recently the annual banquet of a society of engineers in a New England city was held, and at that banquet the Governor of the State, the Mayor of the city, the representatives of the four engineering societies, and others, spoke. The Governor of the State and the Mayor of the city spoke remarkably well regarding the co-operation of engineers with public matters in the service of the State and of the municipality. The Mayor of the city, particularly, said that certain activities carried on under the advice and with the help of the engineering associations of that locality had been carried on much better than it ever had been possible to carry them on before, and he stated flat-footedly that he believed the time had come when it must be recognized that the activities of a municipality involving engineering matters could no longer be satisfactorily conducted under the control of politicians, but that they must be conducted under the power and control of engineers,—a very significant thing to be said by the Mayor of a great city of this country.

The day after that meeting took place the papers of the city were examined to see how they had treated this occasion. One of the papers had in its headlines the name of a prominent lawyer who had spoken well at that meeting on an important matter of international politics. In that talk he endorsed the position taken in a recent book which I believe is called "The Economic Consequences of Peace." He spoke in a very interesting manner, there is no objection to take to that, but it was not engineering. One of the papers had in its headline the name of this lawyer and it had in the headlines no reference to engineers or to an engineering meeting. It went on to say that he had said certain things on this subject at a meeting of engineers held the night before. That was all the publicity that the engineers of that city secured from that occasion, although the speeches were filled with matter that was of the utmost importance to the public if it could have been gotten to them.

It has seemed to me that engineers need to cultivate that particular thing, and that we shall do better if the local societies of engineers can select some one of their number who can, in co-operation with a newspaper man knowing the newspaper game, translate into human and public terms what it is that the engineers are trying to do, why they are trying to do it, and what it means to the public. The newspaper game is a good deal like any other game. One who takes part in it and succeeds must know the game, he must know what will interest the city editor and in what form it will interest him, and engineers are not trained for that work. They see only the engineering side of it. The newspaper man can see the human side of it, and with the assistance of the engineer I believe that combination can usually be made in any locality that will secure for engineers at least a part of the publicity to which they are entitled, and which they ought to have.

This will not be selfish advertising. The public needs our co-operation, but in order to secure that co-operation it needs to understand what we are doing. It is a matter of human experience that when groups of people wish to co-operate or to work together, they cannot do so effectively until each group understands what the other proposes to do, how it proposes to do it, and why it proposes to do it, and that means publicity, which I recommend be given much more attention than engineers have been in the habit of giving it heretofore.

Mr. Baldwin: A distinguished electrical engineer recently delivered an address on "The Last Stand of the Reciprocating Engine." It was quite saddening to many of us who have, for the better part of a lifetime, seen the accomplishments of the steam locomotive (when it was going rather than when it was standing), particularly when we considered the quite remarkable improvements in efficiency that have been made in the steam locomotive during recent years. It would appear that the steam locomotive engineers are taking an unfair advantage of the situation in that just as fast as the electrical engineers perfect new devices the steam engineers produce some improvement that postpones the time when our old-time pets will become obsolete.

It will probably be a great many years before the steam locomotive will "just naturally fade away." None the less we are bound to recognize the fact that the remarkable advances in the use of electricity for propulsive purposes, the simplification of the mechanical appliances for the use of unskilled workers and the extraordinary operating results being obtained from certain installations, coupled with the greatly increased cost of fuel, will undoubtedly make our steam locomotives fade away in a great many localities.

If the A. C. and the D. C. experts would quit this camouflage among themselves about the mysteries of their respective systems and let the public into their confidence, we might feel better about it. Their relationship reminds me of the story of two rival camps of herders in the far West. There had been a great deal of strife among them and bloodshed and finally it came to such a point that the New York owners of the respective ranches concluded it would be advisable for them to go to the scene of action with their lawyers and try to put a stop to the trouble. At the appointed time the lawyers and the owners and the cowboys assembled in a large room, one on one side of the table and the others on the other side. The conversation started and soon became fast and furious. Oaths were exchanged and the lie passed and the atmosphere was decidedly sulphurous, and the cowboys began to get uneasy; you could see them slipping their hands back to their hip pockets, and each was wondering what was going to happen next. Finally one of the lawyers wrote something on a slip of paper and passed it around to the other lawyer. Shortly after that things began to quiet down and pretty soon a more friendly atmosphere prevailed and finally all got together and everything went off smoothly, and they arrived at an amicable agreement and parted. After they had dispersed one of the cowboys who had seen the lawyer that received the note drop it into the waste-basket thought he would like to find out what was on it, so he went back and hunted it up, and this is what he read: "Bill, we have fooled these fellows long enough; let's stop it now; I want to catch the next train; come ahead and let's get together."

Of one thing we may be sure, and that is with such highly trained and practical engineers and executives to push the electrical interests in this country, as the gentleman who fills with great ability the Presidency of the American Institute of Electrical Engineers, the United States will be in the vanguard of electrical development. Born in the middle West, descended from that mixed stock of Cavalier and Puritan that has given so fine a balance to the descendants of many of the early settlers of this country, trained in every branch of electrical work through his many years association with the great Westinghouse Interests, and his direction and guidance of power installations and the electrification of the New York, New Haven & Hartford Railroad, Mr. Calvert Townley is certainly well qualified to do his part in the line of his specialty. I have the pleasure of introducing Mr. Calvert Townley, the President of the American Institute of Electrical Engineers.

Calvert Townley,

President, American Institute of Electrical Engineers.

IT gives me a great deal of very sincere pleasure to come here tonight, officially representing the American Institute of Electrical Engineers, to acknowledge your courtesy in inviting us to participate in this great meeting, to express my appreciation of your cordial hospitality, and the most thorough and sincere sympathy of my organization with the aims and objects which prompted the officers of your organization in starting it.

Some two years ago while crossing the western plains on the Northern Pacific Railroad I entered into conversation with a chance fellow passenger, and in order to make talk as we were passing through a farming country, I said to him, "What is the matter with the farmers? The farmers deal with some of the most fundamental things that this nation needs. They bring out the products of the soil. We could not get along without them. There is every reason why a farmer's business should be stable and prosperous, and yet, as a class, they are poor; they are always having trouble; they are asking for help; what is wrong?" Somewhat to my surprise he said, "The answer is very simple; the farmer has never learned team work." He then went on to say that he was the General Field Secretary of the Y. M. C. A., that it was one of his duties to provide secretaries for the miltary training camps, many of which were then distributed over the country, and that the duties of these many secretaries were to look after the amusements, etc., of the camps, and they found that whereas the city boy took naturally to team work—he had been trained all his life to take part in games and to work with his fellows to do the part assigned him as well as he could—that the idea was new to the farmer. He said, "That is the great trouble with the farmers. They don't understand team work."

Some years ago I witnessed a boat race between Harvard and Yale on the Thames River at London, Conn., at which one crew was very badly beaten. I said to a rowing expert, "How do you account for that? The men in that beaten crew were a husky lot. Why did they make such a poor showing?" "Why," he said, "the other boat had a crew; this one had eight men." Now I believe engineers, we engineers as a class have come to recognize that we must have team work. There is not a more brilliant set of men in the country than the engineers. We have produced many prominent, successful men, but they have won their way by their individual efforts, by their brilliancy or training or initiative. They have not won it by any help from their fellows, and one reason—seeking the cause for this situation—appears to me to be that the engineer's training as a student, before he gets through his college or technical school course, has led him to believe that he must concentrate and specialize to the last degree, that if he does not do that he cannot get ahead. He works as an individual, he expects that he is going to be a professional consulting engineer and he believes that his clients will retain him because of his own individual abilities. He does not seem to think it is necessary for him to associate with others. Consequently, when he is put into a situation where he has to associate, where he has to work together, he has to unlearn a lot of the things that were ground into him as a student.

Of course the modern trend of engineering has made quite a change in the work of the engineer. I suppose it is safe to say that only a small percentage of the men in this room are practicing professional consulting engineers. The trend of the times has made a demand for engineers by our transportation systems, by our industrial corporations, and these men are just as much engineers working for these corporations as when working as practicing consultants, but working in a corporation teaches a man the necessity for co-operation; he cannot go it alone, he must have team work, and therefore the engineers have come, at this day, to see the virtue and the value of team work. I do not believe there is anything but a very small minority in this country who do not now believe in team work. But the trouble with us is we do not know how to go about it. We have to study that question.

The first question that comes up whenever anything is to be accomplished is what do you want to do. You must be able to express yourself very clearly. Take the instance of the little bride who was taking her honeymoon trip, and incidentally at the same time her first voyage on a vessel, who, in response to a question as to where her husband was, said, "I'm not sure, but I think he is up at the sharp end looking over the fence." She had the right idea but she did not express it in the terms common to the sea. On the other hand, when the young man was visiting his sweetheart and he said to her, "Betty, you have broken every cigar that I had in my vest pocket," she said, "The only thing for you to do is to smoke stronger cigars, George." That girl was an engineer. So when we get down to the question of what we are going to do I think of a little boy whom the Sunday School superintendent asked "What have we got to do first to have our sins forgiven?" and he said, "Teacher, commit the sins."

What do the engineers want to do? Where should they begin? Why should they combine? I think the answer to that question is simple and short. It is epitomized in the one word SERVICE. If we are going to combine and do effective work we must do the work for the sake of performing service, service to the city, to the state, to the nation, and to our profession. You are not going to get very far with another man when you announce that you have a new scheme to get something more for yourself and take something away from him. He sort of dares you to try it. But if you show him that you can do something to help him, why you unavoidably excite a spirit of co-operation and friendliness on his part, and he turns to and helps you out.

What is true of the individual is true of the people at large. The great American public is responsive. When you do something for them they are perfectly willing to help you, and it seems to me that it is absolutely clear that the engineers, if they are going to co-operate, must not set their object as the advancement of the engineering profession and themselves. They will not get any help from the public if they do that. But I do believe that there is room for co-operation in the scheme; in fact, I will give you an example that recently happened. It was my privilege to appear before a committee of the House at Washington on behalf of the Nolan Bill. The Nolan Bill is a bill to improve the service in the patent office, and it was not making much progress. But there was an organized movement to present the views of the people at large to this committee, and they went there thoroughly organized. The engineers were represented, various branches of manufacturers were represented, in fact, all of the different classes of people who are interested in taking out patents were there. What were they asking? They were asking that this bill be passed, reminding the committee that most of its provisions were in the nature of increasing the pay of the patent office examiners and other employes so that the service in the patent office could be improved, and at the same time that the fees which should be charged to those people taking out patents should be increased to bear the burden of the additional expense. They were not asking that the United States should take out of its own treasury money to improve the patent service, but asking the privilege of themselves paying more money into the patent office so they could get better service. When the hearing was over the chairman of the committee said that he had never in all his experience attended, presided at or participated in a hearing before a committee of that kind, and he gave us what some of our legal friends said was a decision from the bench. Subsequently the committee put this bill before the House and it was passed without any delay at all. That is what I mean by SERVICE. We were not asking anything for ourselves that we were not willing to pay for. We did not ask somebody else to give us something.

Suppose we say that is the object of the engineer. How are we going to attain it? We have in this country, so I am told, perhaps 100,000 engineers who are organized in one or more of several hundred engineering organizations. The toastmaster said a while ago that you had at least twenty of them in this city. There are, I believe, several hundred altogether, and those organizations are all active. They are all doing something to promote some branch of engineering, each in its own way. They all have their strength, some of them local, some of them national. If those organizations can be made to understand that no one wants to interfere with them, that we are not proposing to take away any of their rights or privileges, that we are not proposing to try to do any of the work which they are respectively doing, but that we would like their help in a general organization or affiliation, whereby each organization would join with the others in considering questions which affect the city, state and nation, or questions which affect engineers at large, in a broad-minded, unselfish way, they ought to be willing to co-operate, and I think most of them would. That is one method which has been discussed a great deal, and which has found much favor among the Conference Committee and others who have discussed it. I believe this is the day of the engineer. The public cannot get along without us, and they do not want to try it; if we make ourselves useful, if we make our influence felt, we can accomplish a great deal, and it is our duty, not our particular personal pleasure, although I hope it will be a pleasure, but it is our duty, as citizens who are in a preferred class by reason of our opportunities for training and education, to devote ourselves to the progress of the country.

They say that this terrible war that we have passed through was an engineers' war. We should not unduly vaunt ourselves and boast of that. Let us be satisfied with our small share in it. There is glory enough to go around, but if it was an engineers' war, in just so far as the engineer did help, as he did make it possible to do things which were never done before, that power still remains with the engineer to continue in peace what he did in war times. Therefore, I say, if it was an engineers' war, let us make the peace which is now upon us, and which we hope will last many years, an engineers' peace.

Mr. Baldwin: I have had the pleasure of introducing to you engineers who are the representatives of societies which embrace the entire gamut of the profession. Men who reclaim waste lands and make them blossom as the rose, build bridges, railroads and canals, men who go into the bowels of the earth and extract their treasure for the benefit of man (and themselves incidentally), men who have created the marvelous engines that have caused this age to be spoken of as the Age of Machinery, and men who harness the waterfalls and the coal mines of the country and transmit their stored energy on tiny threads of wire to furnish power, transportation, heat and light, and now I have another kind of Engineer to introduce, one whose work is to lead men through the stormy ways of life, to guide them past the pitfalls and the sloughs and through the dark morasses and to help furnish them with power and purpose and peace. One whose ancestors sat in the councils of the mighty in the kingdom of Great Britain, and who has devoted his inherited talents for oratory and statesmanship to a greater kingdom and a greater service.

A man who has been gifted with that rare power of associating the ideal and spiritual with the daily practical life of men, and has given his message in many assemblages, from captains of industry to horny fisted sons of toil, from the halls of learning to assemblages of the poor and needy and who now has a message for us—his fellow engineers in the broad sense that all men are brothers.

I have the pleasure of introducing Doctor Theodore G. Soares.

Application of Engineering to Modern Life

By THEODORE G. SOARES,

Head of Department of Practical Theology and Professor of Homiletics and Religious Education, University of Chicago.

I COME as a man of the Church to speak to the men of achievement, and yet so inevitable is the unity of human life that the suggestion that I am in a sense an engineer is not altogether a conceit.

One of my colleagues at the University has a lecture upon the work of the minister, the title of which is "The Minister as a Social Engineer." He has taken from your calling the quality of organization for the purpose of describing the new duty, task, opportunity of the minister in the world. In the same way again and again the speakers tonight have inevitably taken from my calling the word that properly describes the spirit of organization. The engineer as a social minister for social service, which you have said again and again, means only that.

Are we not all coming together and realizing that life is one? It is not material, and it is not spiritual, it is both. It is not sacred and it is not secular, it is both. You simply cannot live in one without living in the other, if you live in any large sense at all.

We are now engaged in the Church in these next few weeks in the raising of an immense sum of money for the great missionary activities. It is most significant to realize that there is an important basis for those activities in what might be called the engineering task of the modern missionary enterprise.

People can never be raised by ideals alone. We have been trying to help the people of India, for example, and what do we find we have to do there? We have to take that great mass of the Indian population and help them to secure a status in the world. We have to give them a certain industrial power. We have to raise them to that manhood which alone comes from having a control of the resources of life before we can get a spiritual and ideal development.

There has been presented in the city during the last week the interesting enterprise of the raising of the ten million dollars in the United States for the Palestine Restoration Fund. The Jews are very anxious to help their fellow countrymen to return to Palestine. But what does it become? At once an engineering problem. They are going to dam the Jordan in order to have electric light and power all through that country. Problems of irrigation are fundamental. Jerusalem, as you know, has been a city practically without water except for the most elementary provision. General Allenby, of course, provided to a large extent the reorganization of the water supply that goes back to the days of King Solomon, in order to make the British occupation of Jerusalem possible.

All great spiritual undertakings go back into material undertakings. The world is one in the great enterprise of life, and the spirit cannot say to the material, "I have no need of thee," nor can the material say to the ideal, "I have no need of thee." So there is a great sense in which the world enterprise is an engineering enterprise, and this is very much more true today than it ever has been before.

I suppose that is the reason that the engineering profession is the very youngest of the professions. The world has only lately come to recognize the need of engineering in any very large sense, because we have only lately got to live such a complex life as we are living today.

When men live apart in separated regions, a few people cooperating together here and there, the great task of the engineer does not appear. But when they live congested in great cities, in populous countries, and engaged in vast enterprises, then the engineer is an absolute essential.

Life until recently has been rather small. Life today is becoming big. One gets almost tired of the use of the term, but there is nothing more fundamentally true than the sheer bigness of our modern life.

In my little house, in which I live at present, we are making some changes that we have been wanting to make for some time. We have been waiting for prices to go down, and for it to be a desirable time to build, and so we have chosen this one. Now, there are half a dozen workmen at work there. There are some plumbers, and some electricians, and some carpenters, and some plasterers, and some masons, and I have had the best sort of a time with those fellows. There is not a man there that is not a fine, clean, straight, manly man. They work eight hours a day. I do not know just what they get. I will find out, I suppose, after a while, but I am inclined to think they are earning whatever they get. They are interested in my little job. They suggest changes and improvements. They offer their advice.

Now, I am simply trying to say that in a little enterprise like that it is a perfectly simple thing to solve the problem of industry. It is the problem of human co-operation with half a dozen men. But suppose you are building a transcontinental railroad instead of a porch to a house; suppose you are building a city, or undertaking some great enterprise that takes thousands of men. Immediately the problem becomes vastly more complex, and this simple human relationship does not settle it.

There is a good deal of nonsense talked in my own profession by men who say that love and brotherliness will settle everything. You need science; you need very careful investigation of all the intricate problems involved, because the relation of ten thousand men to one another is an infinitely different thing from the relation of half a dozen men to one another.

There was a time when the New England town meeting represented the corporate expression of community life. Everybody was called together. "We are going to have a town meeting tomorrow night; we are going to discuss the important question of a new town pump." Everybody had his say. Everybody was there. They finally decided what they would do.

The corporate life of a community then was a comparatively simple matter. But when three millions of people are living together in one city, and you have the problem of supplying water, pure and in unlimited quantities, to all of them, then you must have engineers. You have a great complicated problem on your hands, and you may have to do what a distinguished gentleman who is here tonight had to do in Chicago—you may have to turn the rivers backward in order to get what you need.

There was a time when the affairs of nations were settled in little assemblies of all the people. I suppose some of you have been in Greece. Every visitor to Athens goes, of course, to that wonderful place where, upon a small stone platform, he can stand and know that he is standing where Pericles stood, where Demosthenes stood, and where before those masters of speech gathered the Athenian population while the affairs of a nation, the international matters of that time were discussed and decided upon. It was literally a democracy. The *demos,* the people, the crowd was there. They understood what was discussed and settled the matter. But today, when you have a nation of one hundred ten million people, when you have a world, as we have been reminded tonight, of seventeen hundred millions of people; when you have vast enterprises beyond the understanding of the ordinary man altogether, then you are forced to have the engineer for you have an infinitely larger problem to consider.

I was reading Pickwick again the other day. Everybody ought to read Pickwick once a year. There you have that old London, Pickwick's London, as far away from today as is the time of Julius Cæsar. Take the problem of transportation in Pickwick. In order to run a coach from London to Ipswich all you needed was somebody who knew how to build a coach, and six horses, and a man who knew how to drive, and the transportation problem of a great Kingdom was settled. It is absolutely different when a continent is to be traversed by these iron highways, and when the vast numbers of people and the vast amounts of material are to be taken from one place to another.

So we have come to the time when by the sheer bigness of life we are required to have abler direction than we have ever had in the past.

Lord Bryce has very suggestively said that the growth of civilization in these last few decades, and the promise of the growth of civilization in the next few decades, is vastly more rapid than the growth of the men competent for leadership. The problem today is not to find big things to do. It is to find enough men who are big enough to take the leadership of those tasks. The tragedy of the world today and tomorrow is little men in big places, little men for great leadership; and the need of the day is the trained man and the expert.

It is because of the large contributions that the engineering profession can make in the direction of expertness that it has so important a place in the development of the world's life. I appreciate, of course, the modesty which Mr. Miller expressed as to the place that the engineering profession is to take, simply that of the expert witness, keeping very carefully within its own technical realm.

I was thinking about that expert witness. You know the old saying that there are three kinds of liar, the ordinary liar, the blank liar, and the expert witness. But really the engineer is more than an expert witness. He is the real expert. Of course, one of the serious questions in our democratic world is whether democracy is going to be willing to accept expert leadership. That is one of the greatest questions of today.

How many of us, not the few, but of the great populace to which I belong, were quite willing to give a judgment upon the question which Mr. Davis has so ably discussed—the comparative merits of the Panama and the Nicaragua Canal. You could have received a judgment anywhere on the street corner. How utterly incompetent I am to decide the comparative advantages of the steam locomotive and electric propulsion. I know nothing about it. And yet it is the acceptance of the expert that is going to make real democracy.

There is a pseudo-democracy which says one man is as good as another, one man's view is just as good as another man's. Just put it to the popular vote—as if you could put everything to popular votes. We have to learn in some way to weigh votes as well as count them.

Every now and then I do a very democratic thing. I go to the telephone or ask my wife to go and call a friend of mine to come and see me. He comes and sees me and we talk a little, and he says, "You go to bed." I don't want to go. He says, "You give up that engagement that you have tomorrow." I don't like to break my engagement. But I do both of those, and then he proceeds, standing in my house, to give what he presumes to call his orders. He writes them down so that by no possible chance shall we disobey. We do exactly what he says. Then after a while I get out of bed, and he sends me a bill and I pay it. Why should not I say "one man's opinion is as good as another's. I am not going to have a doctor coming in here and telling me what I will do." That would not be democratic. That would be just plain foolishness. And there is a distinction, you know. All I can do is to exercise my best judgment in choosing my doctor and then do what he tells me. He may be wrong, but I am sure to be wrong.

That is the place that the expert must have in our great modern life. I sit on the Board of Trustees of an educational institution. Beside me sits a banker. Some day there comes an interesting problem of finance. We have large sums of money to invest. Somebody suggests that we buy downtown real estate. The institution is going to last for hundreds of years. Why shouldn't we get some property that in the course of fifty or seventy-five years would be vastly increased in value? Think what Columbia was able to do. Why shouldn't we do that? I immediately say, "Yes, that sounds good to me." Then my banker friend says, "Wait a minute; these are trust funds. We are not allowed to speculate on trust funds; nobody knows absolutely what will become of real estate in the future. My judgment is that we act with conservatism and with care." Shall I presume to say, "I am a member of this board just as much as you are, and I will vote as I please?" Then, again, I am not democratic; I am simply a fool. I rather say, "I think the wise thing for me to do is to take your expert advice.".

Then an educational question comes up. Here is a change in the curriculum, and the banker says, "I am greatly in favor of that," and I say, "Wait a minute, there are some things there that I think you have not seen. I don't know very much, but if I know anything I know a little about education." If he says, "I don't care what you think; my vote is just as good as yours," then he is a plain fool this time.

We have to find out, if we can, the people that are able to lead us in various great interests of life, and we shall be really democratic when we elect our best. An aristocracy is the best form of government, that is, government by the best, but the only way to get the best is by the democratic method of daring to choose the best.

Of course that is one of the difficulties in party politics. They are all very well in a way. I suppose it is the only thing we can have in order to save us from the tyranny of any superimposed organization. But party politics is a very crude method. It simply means that we divide the people interested in politics into two parts. We say to one party "Go in and take the reins of power." We say to the other "Now you find all the fault you can with them." By constant criticism all the faults of the party in power are kept before us. I do not think that any party in opposition has failed to carry out that program. When we have at last found out how bad they are we have to turn them out and put the other party in. Then the people that were in power become the opposition and they do to the others just what they had done to them before. So by a kind of zig-zag we get along fairly well. But the trouble with the whole political system is that it tends to the building of a political machine. Now as soon as you think of a machine, especially in this atmosphere, this engineering atmosphere, you think of something that is going to do something, but the worst of the political machine is that it is simply for the purpose of winning an election, not really of doing anything, and the winning of the election that ought to be the beginning is, as a matter of fact, the end. There simply remains the enjoyment of the spoils of office and all the rest, and you have the pitiful absurdities of modern democratic government.

What do we need there? Not less democracy, of course, but more. An intelligent democracy that will choose its experts and will recognize that after all government is simply the engineering of our common life for all our own best interests. We need municipal engineering in order that a great city may be conducted in the best possible fashion, instead of the absurd way in which most cities are conducted. Unfortunately the Mayor to whom Mr. Miller referred is a very rare kind of Mayor in the United States of America. We shall have to have more Mayors like that or perhaps no Mayors at all. The business manager, the municipal engineer, is one of the great hopes of a better government of the future.

A very distinguished citizen of Chicago was President of the County Board a few years ago. He told me—and it was no secret, because he often said it in public—that he had the greatest difficulty in holding together the members of that board, except for the purpose of dividing up the offices. When they had distributed all the patronage the members of the Board wanted to go home. There was nothing left to do except provide for a few thousands of the sick and the broken in the hospital, and provide for the poor of the city and do all of the things that a County Board was created to do, so they wanted to go home. They had distributed the plums. We must get beyond that. A municipal engineering enterprise is what we have ahead of us. And in the same way a state engineering enterprise. What is a state except a great section of country inhabited by millions of people who want to know how to live their common life to the very best advantage, how to secure the development of their resources, to advance their urban and their rural life, and to gain all the advantages of mutual fellowship and co-operation that can possibly be secured? It is an engineering enterprise. And the nation is not much else. You know it has been suggested that the Presidency of the United States is an engineering proposition.

So that it seems to me, gentlemen of the engineering profession, there is a very great responsibility upon you. You have been altogether too modest. So excellent a thing is modesty that I hesitate to chide you for that. There are professions not so greatly afflicted with it as your own. But of course you have the responsibility of some great federated expression of your ability and of your training and your expert service to the community.

I belong to a profession for which I gladly would speak, for I believe there is nothing that is more important than leading people to see ideals, but I am the last to think that that profession could have any place by itself. I believe vastly in the educational profession, for what can ever be greater than the preparation of the next generation? Wonderful we all feel to be the medical profession, but after all, that is confined to one realm of life; strong and significant the legal profession, but that again has to do with a comparatively limited portion of our life. Perhaps in some respects the most universal profession is that of business, but we have the difficulty that the business man for the most part is not trained. We have an extraordinary number of business men of great ability in America, but they have become so in the process of business. There has not as yet been developed a regimen by which we can train business men.

But there is one profession, practically universal in its interests, and whose training in the understanding of facts, in the measuring of problems, in the assembling of material, in the weighing of resources, and in the actual carrying out of enterprises, which is peculiarly fitted to meet the great problems that are upon the world today, and you have got to take that responsibility.

We do not know, we people outside, how this vast problem of transportation is to be carried on. You have to solve it. We do not know how this tremendously difficult problem of feeding one hundred million people is to be carried on. Three hundred million meals have to be eaten tomorrow. You have to solve it.

A friend of mine in Boston who is an artist is making for us a stained window. He spoke to me the other day rather seriously against modern business. He does not like it. He does not like the standardizing that you are going in for, this turning out of things by the thousands. He is an artist, he just makes one window. The people in his shop are artists. They do not punch a clock. I had great sympathy with his point of view, but I said to him, "My friend, you know there is a little difference. In our church we can wait for that stained window all the time that is necessary, but there are about one hundred million people that want breakfast food tomorrow morning; there must be some standardizing."

There is the question of how these great food supplies will be worked out. We must not have peaches and raspberries rotting in Michigan and people in Chicago too poor to buy them. The housing problem and the household problem: you have got to face those questions in the future. We have to get clean cities, have some way of getting dishes washed, and all sorts of things. You men who are wasting your time building bridges and railroads would better get down to household problems and see how the great engineering task of running a home is to be managed. That is no joke, either. There should be a vastly more concentrated attention upon the simple problems of getting along in the common ways of life by the best genius and direction that we have in the country.

Then of course there are the greater problems of industry, how twenty million workmen are going to live with all the rest of us in helpfulness and confidence and mutual advantage in the great game of business. That is an engineering problem that will tax the genius of any man that lives.

And the great international problems of the future, after all, are not diplomatic so much, not military so much, but engineering problems—the health of the world, the industry of the world, the commerce of the world, the transportation needs of the world, the means by which you will help the people of the world to realize that great fundamental truth that there is only one interest and that is the universal human interest.

You know it is really a spiritual undertaking that you have. It is not just mechanical. It is not just physical. I had a wonderful time for a few months talking with the boys in France just before and after the Armistice. People have sometimes asked me what I said to them. Well, I did not tell them much about Hell, because, judging from their conversation, I thought they knew more about that than I did. And I did not say much about Heaven, for, judging from the way they had met their duty, I thought they knew more about that than I did. I talked to them about life, about what we had to do when we returned home to make that better America of tomorrow, for I have the profoundest belief in a God who is right here, interested in human problems. I believe in a God who is an engineer God, who wants to do things in the world, all these great practical things to make men happier, to make them better.

There is a wonderful story in the old Book of a spiritual ideal, an ideal of a community building that was to represent the common life and the common faith of the people. The man that conceived that building and the man that wrote the laws that were to be interpreted in that building was a man inspired of God. But somebody had to build it, and it is wonderful that the old record says, three thousand years ago, "And the Lord chose by name Bezalel and filled him with the spirit of God, in wisdom and in understanding and in knowledge and in all manner of workmanship." The spiritual conception of workmanship! So shall we make the America of the future, the world of the future, the City of God!

Mr. Baldwin: We thank you, ladies and gentleman, for your very kind attention and for the pleasure of your company. It is particularly pleasant to us to have the ladies with us. I hope their interest tonight has not been due to the fact that they are the inspiration of the engineers who are here, but that they have really found something to entertain them. Surely in that splendid address that Dr. Soares has given us we may all find not only interest, but inspiration.

The Relation of the Work of the Forest Products Laboratory to Engineering

By George M. Hunt,

In Charge, Section of Wood Preservation Forest Products Laboratory, Madison, Wisconsin.

Presented February 9, 1920.

IT is my intention to present something about the laboratory, what it is, and what is has that might interest engineers, so that when faced with a problem concerning the use of wood, the Forest Products Laboratory and its equipment will be at the disposal of the technical profession.

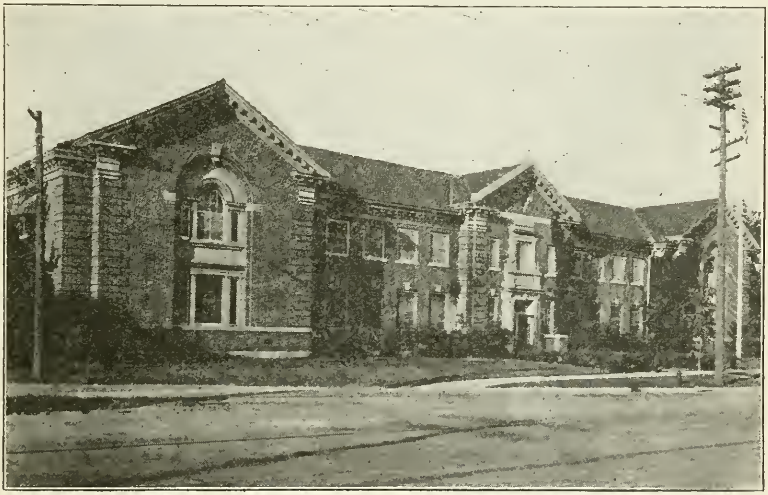
The Forest Products Laboratory is a branch of the United States Forest Service, which is a branch of the Department of Agriculture. The Forest Service has for its principal work the administration of the public forests, protecting them from fire, re-foresting burned over areas, protecting them from timber thieves, and regulating the grazing. The grazing feature alone on the National Forests for cattle, horses, sheep and hogs is a big business. It amounted to over two and one-half million dollars last year in grazing fees. The Forest Service also has, of course, the disposal of the timber that grows on the forests. When the timber is ready to be cut and when a market is available then obviously the thing to do is to sell it. If left standing, it deteriorates, and after a while there remains a forest which is half full of dead and decaying trees.

It would not be right to sell to the public this timber, letting them make what use of it they can, without giving them as much information as possible about what timber is and what are its peculiar properties, how different species vary from each other, and how wood may be most efficiently used in the various lines of work where it finds application. The need for technical data about wood was recognized a good many years before the laboratory was established, and efforts were made to collect information of this kind. For many years people have been interested in the study of wood. There has never been a concerted effort on an extensive scale to gather the technical data that is needed.

During the years before the laboratory was established the Forest Service maintained testing laboratories at various universities throughout the country. A timber testing laboratory was located at the University of Washington, one at Colorado, and one at Purdue. It was quite evident that this method of collecting data was inadequate and could not properly cover the field. Ultimately this resulted in the establishment of the Forest Products Laboratory at Madison in 1910. It is located in buildings belonging to the University of Wisconsin, although it is a federal institution. The University co-operates with us to the extent of furnishing a good part of our quarters with light, heat, power and water, and various other necessities and conveniences.

The field of forest products is a very broad field when studied carefully. It does not consist merely of strength tests on timber or of studying the chemical products that can be made from wood. There are unlimited fields for study and in order to attack the problem in the best possible way, the organization of the laboratory was grouped into a number of sections. We have the Director and the Assistant Director in general charge of the work, then five technical sections.

The Section of Timber Physics includes kiln drying. The importance of artificially seasoning timber became evident during the war when a stock of air dried timber was needed for making vehicles and artillery trucks, automobile trucks, propellers, airplanes, and the various other implements of war—and of peace also—where wood was required. Seasoned timber was not available. There was only one thing to do, and that was to cut down the green trees and season them.



Main Building, Forest Products Laboratory

There had always been a prejudice against kiln dried timber. It has been said that when timber is kiln dried the strength is reduced, it breaks easy, and that it will spoil in a dozen other ways. They were correct in part. Unless the timber is properly dried it is injured, but the tests that have been going on for the last ten years, and especially those during the last two and a half years, have shown conclusively that timber can be kiln dried without injury. In fact, if the drying is properly done, the timber is likely to be a little bit better than it would be if air dried.

The time required by kiln drying, of course, will depend upon the size of the timber. If it is inch boards it can be dried much more quickly than four by four or six by six wagon stock; but whatever the size of the timber, it can be dried much more quickly in a kiln than by air seasoning.

It was necessary to draw up specifications for the kiln-drying of spruce, for instance, for use in airplane wing beams and struts, and the kiln drying of walnut for gun stocks. That was done by army officers who had the work in charge, co-operating with the laboratory and together working out the specifications. Those specifications proved to be very successful, largely because the laboratory had studied kiln drying for years.

Kiln drying work is being continued, because the demand for timber is, if anything, greater now than it was during the war, because of the demands of the furniture industry and various other industries which were partly closed down during the war, but are working full force now.

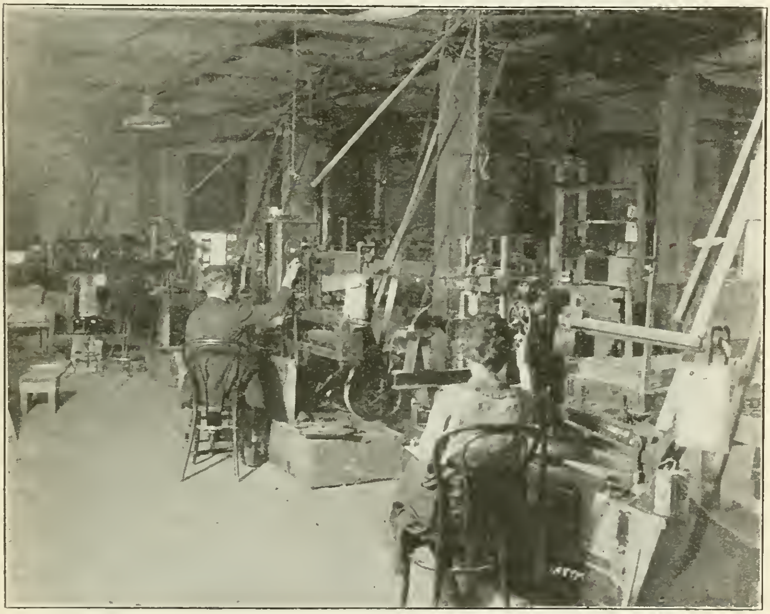
In section of Timber Physics they also study the microscopic structure of timber. The microscope is a valuable instrument in the study of forest products and tells a great deal about timber that cannot be learned in any other way. It tells why it is easy to force wood preservative through a red oak stick when it cannot possibly be forced through a white oak stick. It tells the difference between a piece of pine and a piece of fir or a piece of spruce. By means of the microscope species of wood can be identified that cannot very well be identified in any other way, and since the properties of wood depend very largely upon the species, identification is often very important.

As an illustration of the practical use of the microscope I can cite one instance. A few years ago a railroad company was buying several carloads of oak ties. They ordered white oak. When the ties arrived the railroad men claimed they were red oak, while the tie contractor claimed they were white oak. Both parties secured samples of the ties in question and brought them to Madison. They were examined under the microscope and it was found that the shipment contained both white oak and red oak.

This work of the identification of species was also of some importance during the war, because, using a number of foreign woods, it was important that some of them be excluded because they were known to be inferior in quality.

Another section of the laboratory has to do with the study of the manufacture of pulp and paper. Just now this work is assuming greater importance than it has in the past on account of the paper shortage. Paper manufacturers are finding themselves facing an increasing demand for paper and a decreasing supply of raw material. This means that they have to get greater efficiency out of their manufacturing processes and they also have to prepare for future supplies of raw materials.

Some of the mills in the East have practically reached their limit in wood supplies, although some few fortunate concerns have enough wood to last them many years. The laboratory during all the years of its existence has been studying the paper making properties of various American woods, chiefly those which grow in the National Forests in the West, and there are now in the Pulp and Paper Section, samples of paper made from nearly every species of wood that grows in the West. When the time comes for the Eastern manufacturers to move west the Forest Service has the data to give them concerning the kind of woods they can use successfully; not only that, the Forest Service has located numerous places on the National Forests where there is water power and timber available so that the mills can establish themselves and have a continuous supply of raw material. It does not seem likely that many of the mills will move west very soon, because of the high freight rate that must be paid on paper to get it to eastern markets where it is most needed. It seems unfortunate that the timber is in the West and the principal market for the paper in the East. It is a thing we cannot help now, although it could have been remedied a hundred years ago.


Timber Testing Laboratory

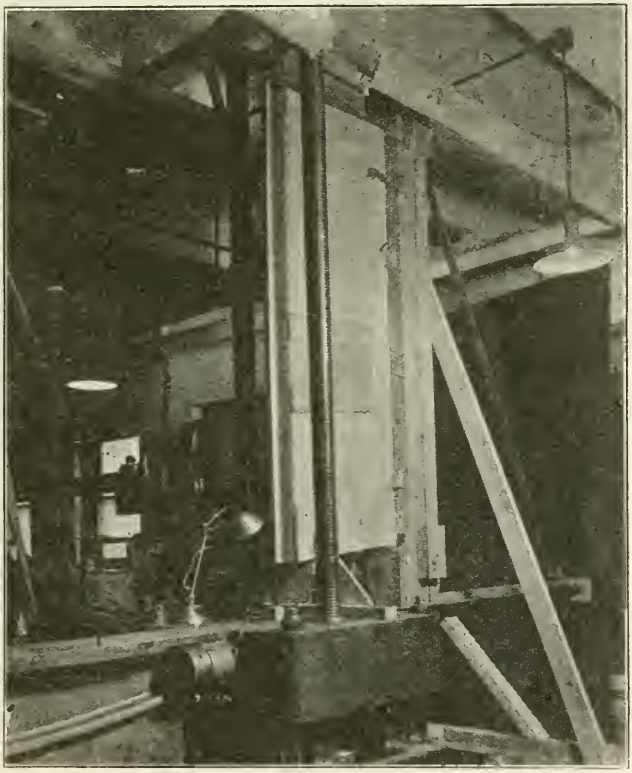
One big chance for the paper men to help themselves now is in controlling the decay that occurs in pulp wood. They buy this wood in enormous quantities and stack it up on the ground without any protection against decay. Some of the wood as it comes to them is partly decayed. Much of it decays in storage before it is used. Fire hazards are thereby increased. Decayed wood ignites much more easily than sound wood, and there have been many disastrous fires in pulp wood storage yards largely on account of sparks falling on decaying or partly decayed wood. The Associated Factory Mutual Fire Insurance Companies have studied this question and, I understand, have reached the conclusion that, for the protection of those wood piles, decay must be prevented.

Decayed wood does not make paper. Paper is made from the sound fibers in the wood. When wood is completely decayed the fibers are ruined, but it occupies just as much space as sound wood. It requires as much handling. It requires as much chemicals to prepare it. When it is put into the digesters with other wood and pulped, however, the yield is found to be greatly decreased. The amount of decrease, of course, will depend upon the amount of decay. Recent tests indicated that about 840 pounds more of wood partially decayed are needed to produce a ton of pulp than when sound wood is used. The yield from wood is around forty percent, or a little more. On that basis it takes more than two tons of oven-dried wood to produce a ton of pulp. It means enough paper, if this condition existed throughout the industry, to overcome the present shortage. So it is a big problem. Of course the problem is not so much to tell the paper man that decay is reducing his return, but to show him how to prevent that decay.

A third section of the laboratory is called the Section of Derived Products, or, as we commonly refer to it, the Section of Chemistry. That has to do chiefly with products other than paper, made from wood by chemical processes. Under this section is included wood distillation, of which one of the principal products is wood alcohol. It is possible by chemical processes to make either grain or wood alcohol from wood. The costs of production are very high, though.

Under this section also we have the study of the naval stores industry,—the production of resin and turpentine. Turpentine is made by wounding southern pine trees, collecting the gum which flows from these wounds and distilling it. The oil that distills over is turpentine and the residue left is resin. Tests by the laboratory, continued over a number of years, have shown that it is possible to very materially increase the yield of turpentine from the trees by regulating the method of wounding or scarring the trees. It used to be customary to chop a box as they called it, or a deep notch in the base of the tree. The gum would then run down into that and be dipped out occasionally with paddles. That resulted in ultimately killing the trees and making them very susceptible to fire. The cup and gutter system replaced that method. Instead of cutting a box in the bottom of the tree a cup is hung which collects the resin. Common practice was to renew the scar on the tree about once a week cutting away a chip about an inch long and an inch deep. That meant that every week the scar would move up about an inch, so that after a certain number of seasons the limit where it was practical to work that tree would be reached. It was discovered that by cutting a chip half of the height of the height larger yields of turpentine could be obtained and the face would not advance so far up the tree during the season, and less injury was done to the tree. That was a step towards real conservation.

One very technical part of the work of this section is the study of the chemistry of wood. What is wood composed of? Wood is an organic material and its chemistry is exceedingly difficult. A great many books have been written on cellulose, yet nobody knows exactly what cellulose is. That is only one of the materials which we find in wood. There are many others, some minerals, some oils, gums and resins, and then there are a number about which little is known. They are grouped together under the term lignin. When the chemistry of wood is obtained it will be of great value in various ways. That is one of the things that we are doing, but about which the public hears very little because there is so little information yet which can be applied to bring results.



Testing a Door

Perhaps the section which would be most interesting to the Bridge and Structural Section of this Society is the Section of Timber Mechanics. This is a section which studies the mechanical properties of timber, which attempts to find out why one timber is strong and another one is weak, which attempts to find the average strength of various species of timber.

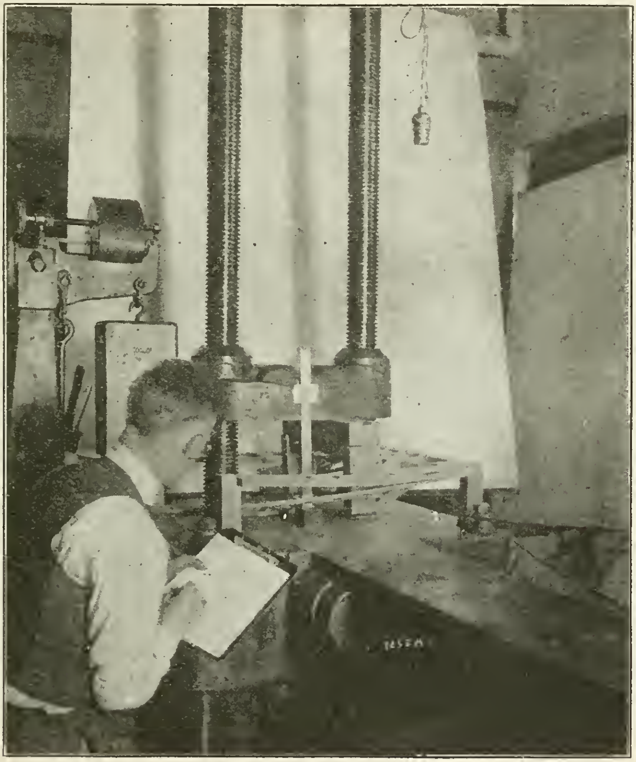
One thing included in the study of mechanical properties is the relation of the strength of timber to its density. It has been conclusively shown that the strength of a stick of timber, other things being equal, is very largely dependent upon its specific gravity, its density, which means, to be exact, the amount of wood substance there. Wood is composed of woody material and air and the more woody material there is in a cubic foot of wood, the greater its density and the greater its strength. That is a general rule. There are exceptions to it, and slight variations from it. Ordinarily, a person is likely to think that the strength of oak is so much; the strength of pine is so much;—that is the general impression. As a matter of fact, one can get pieces of oak that are much weaker than pieces of pine, and pieces of pine that are much weaker than other pieces of oak. It is easy to get pieces of pine which will have less than one-third of the strength of other pieces of the same species, and to the man uninformed, it is hard to tell the difference.

The need for some means of telling the difference has resulted in density grading rules for structural timbers. By means of these grading rules it is possible for a man with relatively little study to select the wood which has the required strength and thus eliminate the weak timbers. The relation of density to strength, of course, assumes that all other factors are equal, but of two sticks of equal density one may be spiral grained and the other straight grained. The spiral grained stick will be weaker.

There is one line of work under the Section of Timber Mechanics which gives promise of being of immense value to the country as a whole, although perhaps it is not of direct interest to engineers in their profession. That is the box laboratory where boxes, barrels, and containers of various kinds are tested to determine their weaknesses. Many boxes are redesigned to give the strength needed to carry their loads. This laboratory was used to a great extent by the Ordnance Department during the war in designing its boxes for over-seas shipments. It was found possible in numerous cases to re-design boxes which were determined weak so they would have the strength required and yet save from ten to forty percent in shipping space.

Over-seas shipping space was valued at several dollars per cubic foot, and a saving of twenty percent meant much when shipping space was so limited and the necessity of getting the supplies over so great. It is still possible for the shipping public to effect economies which will save them in shipping charges and which will save them enormous sums in losses from damage during shipment.

A new development in timber construction which is receiving increased attention is the use of laminated members instead of solid members. As timber becomes more expensive and the larger pieces are harder to get, it is of greater advantage to be able to use smaller lumber and build it up into the sizes and shapes desired in structural members. In doing that, it is necessary to know the effect of various methods of fastening these laminations together; one must know the effect of defects. Can we put five 2-inch planks together to make a beam, allow defects in three of those and get sufficient strength? If we can allow defects, in what part of the member can they be permitted? Does the strongest plank of the five break first or does it break last? Those, and numerous other questions can be asked, but some of them cannot very well be answered until a great deal more work is done.



Testing an Airplane Engine Bearer

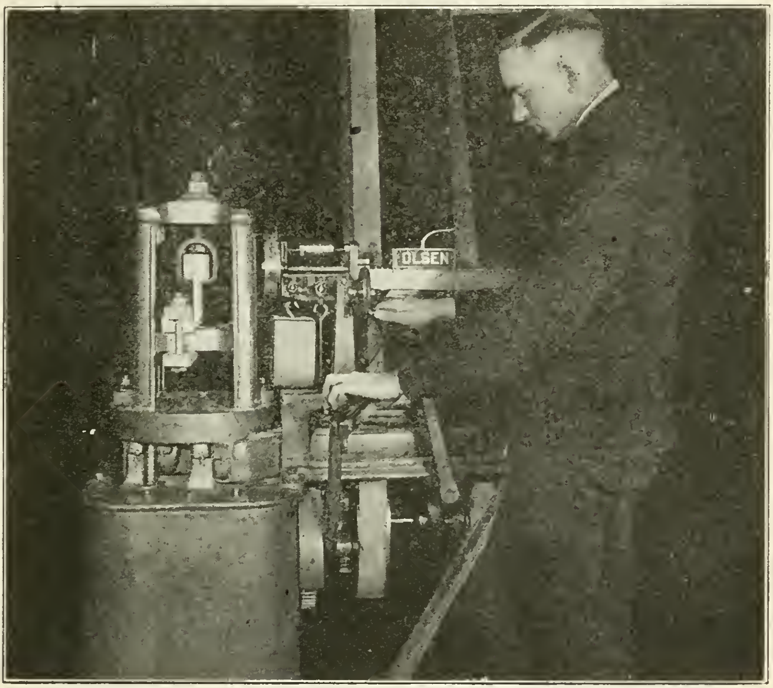
One more part of the work of this section which developed during the war and which will also be of use now, is the application of strength properties of timber in aircraft construction. Why was spruce selected as the best timber for aircraft? Because tests had shown that, weight for weight, spruce was stronger than any other timber we could get in commercial quantities. There are many other species that are stronger than spruce; oak and southern pine and Douglas fir, for example, but pound for pound the spruce was the strongest. When conditions became such that they could not produce enough spruce, it became necessary to permit the use of some other species which would approach spruce in these properties. By the tests that had been made through a period of many years it was apparent that Douglas fir was about the next best species to use. The use of Port Orford cedar was also permitted and other species were considered, but not used to a large extent.

A new field which aircraft production made us study was the mechanical properties of ply-wood. It is made up of sheets of veneer with the grain of alternate plies running in opposite directions. As a structural material, it has somewhat different properties from solid wood. Ply-wood cannot be split as easily as the same thickness of solid wood. Its tendency to shrink with changing moisture conditions is different. Methods of fastening are different. It is a new material for the structural engineer to work with, and it must be studied so he will know how to use it to best advantage. It is a very important material in aircraft construction. By means of ply-wood it was possible to design airplane wing ribs much lighter and stronger than they could be made of solid wood.

In the Section of Wood Preservation we formerly confined ourselves to the study of the preservative treatment of wood, the durability of wood and the fire-proofing of wood. But because we were called on for so many other things during the war, we had to include also the study of glues and glueing, the study of the manufacture of airplane propellers and methods of coating wood to prevent the entrance of moisture. An airplane propeller is a rather delicate instrument. If it is not properly balanced it is likely to tear the engine from its bearings when it gets to going 1500 or 1800 revolutions per minute. If it warps a little bit more on one side than it does on the other, it is apt to be inefficient, or to damage the machine. It has been found that changing moisture content causes the warping and shrinking of wood. When water leaves wood it shrinks. When water is absorbed by wood, the wood swells. If wood is to "stay put,"—to remain at the size desired,—the moisture must be kept from changing back and forth.

Airplane propellers are used out in the open and cannot be protected like a piece of furniture. They needed, then, a method of keeping out moisture which was better than anything we knew of. It is commonly considered that varnish will prevent the absorption of moisture. As a matter of fact, varnish merely retards the absorption. Ultimately, if the varnished piece of wood is kept under constant conditions, the moisture will come to practically the same point that it would if there were no varnish present.

Various methods of preventing moisture changes were studied. Finally, by accident, as much as anything else, a method which is nearly one hundred percent efficient was discovered. This is done by first sizing the wood, then coating it with varnish, then, while the varnish is still "tacky," laying very thin aluminum leaf on it and afterwards varnishing again. That gives a thin metal coating around the wood. Its weight is negligible. It takes less than half a gram of aluminum leaf to coat an eight-foot propeller. The aluminum leaf is so thin that it takes about 15,000 sheets to make an inch. The cost of it is practically nothing. So we have, for airplane propellers, a means of keeping out moisture that is entirely practical. The process also has possibilities for other purposes that have not yet been worked out.



Nail-pulling Test

We have a big subject in the study of glues. Before we entered the war not much was known about water resistant glues. Even before Columbus discovered America, animal glues had been in use. People were acquainted with their uses and knew how to make them. But water resistant glues were not very well known. In Russia they had a glue made of blood with which they could glue together ply-wood which would stand long soaking or even boiling in water without separating. When it came to making airplanes and seaplanes we practically had to have water resistant glues, so the subject received intense consideration during the war and a great deal of progress was made towards developing glues which will resist water. We are still a long way from a perfect glue, which would be, as I understand it, a glue which would hold wood together under any conditions, which the wood itself will stand.

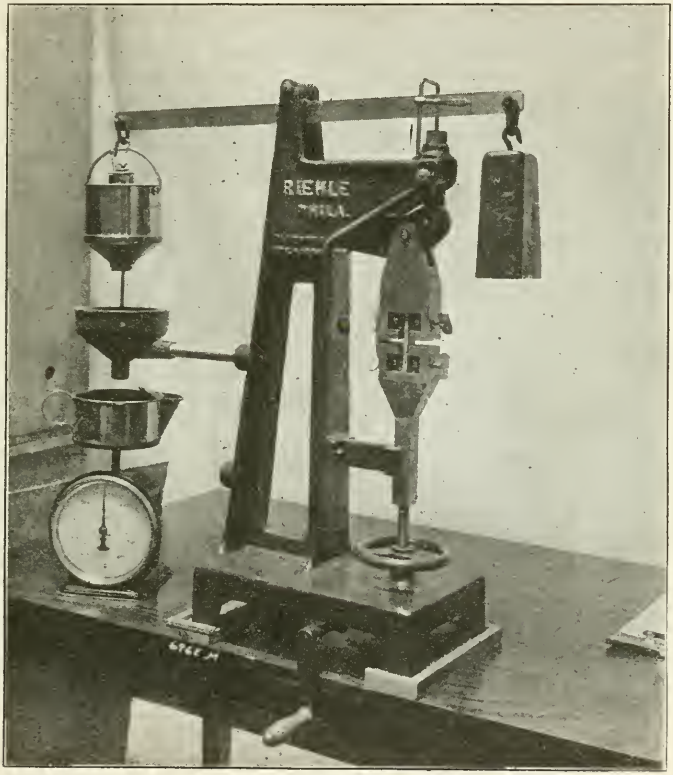
You may not realize that glue is really a structural material. It permits the manufacture of ply-wood and out of ply-wood airplanes are made. If we had this ideal glue our whole system of forestry might be altered. By means of glue small pieces of wood can be joined together to make large pieces. Waste wood can be used in that way to a greater extent than available means now permit. We would not have to wait for trees to grow so large as they do now to get large timbers. Until we find that perfect glue, however, we will have to continue along many lines very much as we have in the past. We must take advantage of each progressive step and use it to its fullest measure, and hope that some day, somebody will find the perfect glue.

In wood preservation we have studied methods of injecting preservatives into woods; how different woods take preservative treatment; and methods of protecting piling against decay and marine borers. How can the damage created by marine borers be prevented? A great deal, of course, is already known. The use of creosotes is fairly well, but not well enough, understood. We do not know what is the best creosote to use against marine borers. We do not know how to get the best penetration; how to get the oil in uniformly and deeply enough. It will take a long time to find the preservative which will prevent marine borers from attacking timber throughout its useful life. The same is true, to a certain extent, of preventing decay in land structures, in railroad ties, for instance. It is a simple matter to treat a railroad tie so that it will not decay, but to do that at a reasonable cost is not so easy.

One line of work which we are carrying on is the collection of service test records on ties, piling and structural timbers of various kinds. This is being done with the full co-operation of associations such as the American Wood Preservers' Association, the American Railway Engineering Association and others. They are furnishing us a great deal of data. We are getting all we can and building up a mass of data from which it will be possible to draw very definite conclusions. We cannot draw conclusions from one test and be sure they are right. That one test may give the extreme result one way or the other and be fifty percent off the average, but if there is a mass of data, then it is possible to know what to expect, on the average.

In the Wood Preservers' Proceedings this year will be published a catalog of the service test records we have on railroad ties. There are about forty pages of that record and the laboratory stands ready to give to any engineer or anyone else who needs the information, specific data on the condition of any individual test of which we have record up to the date of the most recent inspection. That service we hope to extend to piling and poles and other timbers.

It is not enough to put yourselves in a laboratory to study and learn things and then file them away some place. Unless the information is given out so that the people who need it can make use of it, the time is wasted. One of our principal activities is to disseminate the information we secure. That is done in numerous ways. It is done through occasional public lectures. It is done through journal articles. You will find articles bearing on various phases of the work of the laboratory, giving the information that has been developed in one line of experiments or another, in most of the technical and lumber journals.



Machine for Testing the Strength of Glue Joints in Flywood

Then there are government bulletins. It takes so long to prepare and publish a government bulletin that by the time it is out the information is usually pretty cold. So our policy is not to wait, not to hold back the data until we can publish it in the government bulletin, but to put it out in these various other ways and then, when there is enough data accumulated, put it in the bulletin for a permanent record and for future reference. When a bulletin comes out it does not necessarily give information that has not been told before. Usually it does not.

More and more people are learning what the laboratory is and what it has, by writing in for information on technical problems. Sometimes they get what they want. Sometimes they must be disappointed because the information is not available. We give them the best we can.

A new departure in the system of disseminating information is the "Technical Notes" which have been appearing in sets, about once a month for nearly a year. They are merely one or two page abstracts of information we have obtained which is useful to engineers, chemists or others interested in wood products. There have been about 90 of these technical notes issued to date and we are glad to send them to anyone who is interested.

We also co-operate with various associations by working on their committees, helping the committees in the preparation of specifications and in various other ways in which the laboratory information can be made useful. We also have moving picture films and are now giving a course of personal instruction. This is something which is entirely new and has never been done before.

Last week we finished a course of instruction to 11 men interested in kiln drying. In April two courses are to be given, one for men interested in the use of glues and another for men in kiln drying. Just now a course of instruction is being given in the design and testing of shipping containers. I have listed here some of the items of information we have which it seems to me should interest various engineers.

The railroad engineer and the wood preserver should be interested in durability data, in protection of marine piling, methods of preservative treatment, the use of wood in railroad car construction, and the effect of preservative treatment on the strength of wood.

The chemical engineer can find information on the use of wood in chemical apparatus, upon pulp and paper problems, on wood distillation, naval stores products, the manufacture of alcohol, and other chemical products that may be made from wood.

The structural engineer and architect can find information on safe working stresses for structural timbers, the effect of defects on strength, the effect of seasoning on strength, density grading rules, the durability of various species of wood, the efficiency of joints and fastenings, and the strength of built-up or laminated structural members.

The aircraft or automotive engineer will find information on aircraft design. We have done quite a little work on the design and testing of individual aircraft members such as struts, wing beams and wing ribs and even whole wings. He will also find information on the mechanical properties of ply-wood, upon water resistant glues and other glues, on propeller manufacture and on protective coatings for wood.

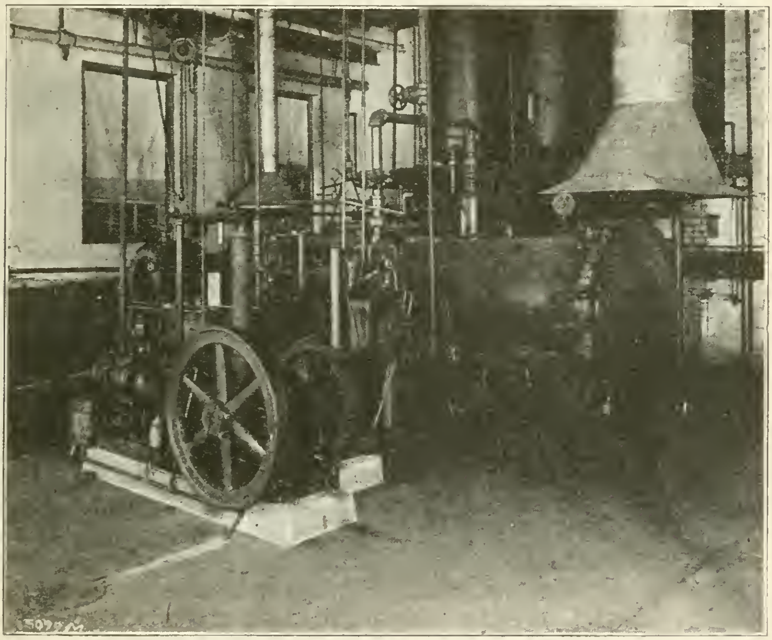
All engineers will be interested in the conservation of a national resource.

CLOSURE

Presented by George M. Hunt

In closing, I wish to summarize the informal discussion of this paper.

Woods for Propellers:—For combat propellers black walnut, true mahogany, white oak and one or two other species were approved. For training machine propellers several other species were used.



Treating Apparatus in Wood Preservation Section

Basis for the box tests:—The revolving drum of the box testing machine is designed to give the box rough usage similar to that it commonly receives during shipment.

Casein glues:—Casein glues have been developed to the point where they are, when properly used, as strong as any wood which is likely to be glued with them, and that is as strong as any glue needs to be. In considering ultimate strength, it is probable that animal glues still have a little advantage over casein glues, but the casein glues have, if properly used, enough strength. They are becoming more extensively used because they fulfill a want that has existed for a long time in wood working, and because there are a number of business houses that are actively promoting their sale. There are new casein glues being produced and put on the market at rather frequent intervals. It is a new business, and it is going to take quite a while yet before it will get on the same stable basis as that of the animal glue industry.

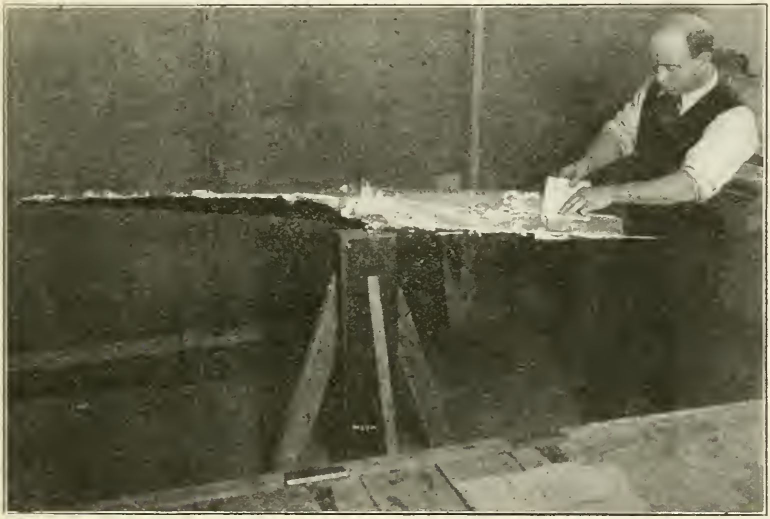
Relation between shearing strength of glue and strength in other directions:—The shearing stress is the one to which glue joints are most generally put. If an airplane propeller is bent a little either way, what stress is put on the glue joint? It is a shearing stress. About the only place where tension is likely to be put on a glue joint is where two pieces of wood are glued together end to end or side to side, then pulled apart. That seldom happens. An end butt joint is a difficult one to make strong with glue for the wood is exceedingly strong in tension with the grain. I do not believe anyone can make a glue joint that will stand as much as the wood in tension parallel to grain. In joining two pieces together sidewise and pulling them apart, the wood is very weak and one can easily get a glue joint that will hold, or if a weight is put on the middle to bend it, the glue will be found stronger than the wood. Where it is necessary to make an end joint the difficulty is overcome by making a scarf joint in which a direct pull produces shear as well as tension and the glue can stand the strain.

We are working on what slope should be in that scarf right now, testing various kinds of glued joints. Does a flat joint, joining two boards together edgewise, have as much strength as a "V" joint or a serrated joint? I think the flat joint has as much strength as the others.

Use of glue for built up structural timbers:—So far as strength is concerned, I would say it is possible right now to build up a perfectly satisfactory beam or post out of inch boards or 2-inch lumber, provided good wood is selected. A good beam could not be made from poor lumber. The glues we have are not water-resistant enough to depend on for twenty or thirty years, if there is a possibility of the beam getting wet. They might weaken due to absorption of moisture, but so far as strength alone is concerned, we have made many tests which indicate that we have enough now. We built experimental laminated wing beams for airplanes during the war out of spruce. The army did not find it necessary to use them on a production scale, but they were about ready to when the war stopped.

Durability tests on wood of different density:—It is very hard to make durability tests on lumber having different densities, on a small scale and have them mean much. We ourselves have not done a great deal along that line. The Southern Pine Association, however, has done some work which, while it is not conclusive, is indicative of the fact that the more dense lumber is, within a given species, the more durable it is likely to be. There is more wood substance there, and it would naturally be expected that it would take a little longer for it to be destroyed; but as between different species, the density has no apparent effect. Our most durable species happen to be some of the lighter woods. There are also some very durable dense woods. Of the light woods, redwood, cypress and cedars may be used as examples. Osage orange is very durable. White oak is quite durable. The same point I made before is true here,—in order for durability tests to mean very much, there must be a mass of data so one can take an average of the whole. One test or two tests may give one extreme or the other, and one may miss the average a long way.

Marine borers in fresh water:—There is little need to be concerned about marine borers in fresh water. For the most part they live in the ocean and when they get into fresh water it is fresh water directly connected with the ocean. There are no borers in the Great Lakes. There are none that I know of in any of the fresh waters that are more than two hundred miles from the ocean, and it is very seldom they are found beyond the brackish water.



Covering Airplane Propeller with Aluminum Leaf

Durability of piling in fresh water:—A wood which is completely submerged in water will never decay. In using piling in fresh water, where there is no need to be concerned about the borers, if the piling is cut off below the low water level, that wood will last forever, or until the water drains away from it.

This is true regardless of species. Any species of wood will last forever if kept constantly saturated with water, or if kept continually dry. Pieces of piling and sticks of timber have been found submerged in water, that have come down from the time of Caesar, and are still sound. Wood that is buried in the earth down beyond the point where it can get air will last forever.

Above the water line the same difficulty exists that is met on land—decay can take place. Decay occurs when there is the right balance between the moisture content of the wood and the oxygen supply; a fungus must have air; it must have water; it must have a temperature at which it can live, and it must have food. The wood itself is a food. When all the conditions are favorable to the growth of the fungus its growth can only be prevented by poisoning the wood with a preservative. Different species of woods, however, have different durabilities, so the question when selecting piling is —Is it cheaper in your case to build a dock that will last ten years or twenty years or thirty years? If the long life is desired, is it cheaper to use a wood which is naturally durable, like cedar, or will it be cheaper to use a wood that is not naturally durable and make it durable by preservative treatment? A general answer cannot be made. Local conditions will determine for each case.

Strength of piling when wet:—The strength of wood decreases with increased moisture content, up to a certain point, the so-called fiber saturation point. Above that point additional moisture does not decrease the strength of wood. Large structural members are always air seasoned. In air seasoning defects develop, they check, and shakes may develop. In some cases they may decay, so that in seasoning a large stick the benefit of the increase of strength due to decreasing moisture content which would be expected in a small clear stick may not be obtained. As the moisture content decreases, defects may be caused which offset the theoretical strength increase so that for structural members including piling the strength factor used in design is usually the green strength. Therefore, the moisture content of piling is not considered in designing structures.

The value of the Card process for preserving ties:—One thing we always try to avoid is getting into controversies over patents, and for this reason we do not publish statements comparing patented processes. Railroad engineers, however, seem to be willing to pay for the Card process. They have the choice of using the Card process or straight zinc process.

Service test records are very valuable. There are thousands of ties throughout the country treated by the Card process, thousands of them with straight zinc, and thousands with other preservatives.

What does the laboratory recommend concerning reforestation:—Of course reforestation is outside the field of the laboratory. We are concerned with wood as a material, after it is cut from the tree. But the Forest Service is very much concerned over that problem and Mr. Graves, the Chief Forester, has caused a lot of discussion during the last year by ideas he has put forth concerning the conservation of the public and private forests, and methods of handling the land that has been cut over. When land is suitable for agriculture after the timber has been cut off, perhaps the best thing to do is to farm it, but the land which is not suitable for agriculture is very frequently well adapted to the growth of timber. The question is, what timber should be grown? A species which is useful to the industries in that region is desirable as well as a species which will give as great a return as possible on the investment. The paper mills like spruce; that is one of the best woods they can get for certain grades of paper. In some parts of the Adirondacks quite a bit of trouble is experienced in getting spruce to grow, or rather to keep the hardwoods from shading out the spruce. They are attempting, in certain regions, to favor the spruce at the expense of the hardwoods.

A forest fire burns up thousands of acres of good timber. Usually, unless the fire is exceedingly intense, there are a few trees left standing which are likely to seed that area. If the area is protected from further fires the trees will grow up and in time the country will be reforested. It takes a long time to grow a forest, however, and in many cases the young seedlings are not protected. People think seedlings are worthless and let the fire run through and destroy them year after year. Finally nothing is left but a waste tract. If the country happens to be very hilly it is then likely to be gulleyed out very badly by water. In some of the southern states in the hilly countries where the country has been farmed for a while and then left idle it is washed out very badly. The pine trees are doing the best they can to fill it up again and protect it.

The Forest Service is anxious to establish a national policy for making private land owners responsible to the public for protecting the land under their control, and for getting the states to give proper protection to the reforesting of waste lands. Some disagree with the Forest Service about the details of the methods that should be used, but all agree on the one fact that a national forest policy is needed and needed right now.

May 5, 1920

Proceedings of the Society

Meeting No. 1069, March 1, 1920.

This was a general meeting of the Society, there being 38 members and guests of the Society present. Mr. Wharton Clay, M. W. S. E., Commissioner for the Associated Metal Lath Manufacturers, presented a paper on "Engineering in Trade Associations' Work." Mr. Clay explained the purposes of trade associations in general. Engineering has been applied to the management and promotion of these organizations, he said. It has been shown that the man with the technically trained mind is more capable of increasing the prestige and efficiency of the organization. Application of Engineering methods to such organizations has brought about closer co-operation between competitive industrial plants, he showed. Many members of certain industries now waive all claims to patents and exchange ideas freely for the benefit of the industry. This is especially true of the automobile industry, he said. The meeting was adjourned at 9 p. m.

Meeting No. 1070, March 4, 1920.

This was a joint meeting of the Electrical Section, W. S. E., Chicago Section, A. I. E. E., Chicago Section, A. S. M. E., and the Western Railway Club, there being 69 members and guests present. Mr. S. T. Dodd of the General Electric Co., Schenectady, N. Y., presented a paper on "Some Comment on the Present Status of Steam Railroad Electrification." Mr. Dodd showed the progress that has been made on various roads throughout the United States in electrification. He also reviewed the types of equipment which have proven most efficient in this movement. The meeting was adjournd at 9:30 p. m.

Meeting No. 1071, March 19, 1920.

This was a joint meeting of the Mechanical Section, Western Society and the Chicago Section, American Society of Mechanical Engineers. There were 200 members and guests present, including many ladies, at the Morrison Hotel at dinner. Mr. William White illustrated his address on "Development and Use of Niagara Falls Water Power" with motion pictures giving views of the Falls and the Niagara River at various points. Interesting progress has been made on the development. The construction of power stations is going forward at a rapid pace, Mr. White said. There was an interesting discussion at the close of his paper. The meeting adjourned at 10 p. m.

Meeting No. 1072, March 29, 1920.

This was a joint meeting of the Electrical Section, Western Society and the Chicago Section, American Institute of Electrical Engineers. There were 115 members and guests present. Mr. O. B. Blackwell, transmission development engineer of the American Telegraph and Telephone Company presented a paper on the "Transmission of Intelligence." Mr. Blackwell traced the development of communication between peoples from the most primitive methods of the savage. Gradually he took up the more modern form of transmitting intelligence, such as the telephone, telegraph, the wireless 'phone and wireless telegraph. He explained the radical improvements that are being made from time to time to the great trans-continental and trans-oceanic lines of communication. The discussion of this subject was very lengthy and many interesting points were brought out. The meeting was adjourned at 9:30 p. m.

Meeting No. 1073, April 5, 1920.

This was a general meeting of the Society, attended by 28 members and guests. Prof. Grant Beebe, Principal Calumet High School, Chicago, presented a paper on "Secondary Technical Education," dwelling especially on the vocational training that is being given to students in the local high schools. He explained the details of the Smith-Hughes bill now before Congress.

He declared that there must be greater appropriations for educational work in the school of the country if the maximum benefits of education are to be obtained. Edward C. Rosseter, Principal Tilden Technical High School, in the discussion took up some of the practical work that was being done at that institution. The meeting was adjourned at 9 p. m.

Meeting No. 1074, April 12, 1920.

This was a meeting of the Bridge and Structural Section of the Society with 185 members and guests in attendance. J. E. Love, vice-chairman of the section, presided. Mr. Hugh E. Young, Engineer of Bridge Design, City of Chicago, presented a paper, illustrated with numerous lantern sildes, on the "Engineering Features of the Michigan Boulevard Improvements with Particular Reference to the Boulevard Link Bridge." Mr. Young prefixed his paper by briefly reviewing the history of the improvements and the work done by the Board of Local Improvements. He showed the difficulties in the way of all large municipal improvements, caused by the objections of citizens who do not realize the value of the improvements. He took up the detail of design of the new Link Bridge that is to be ready for traffic May 14. Not only the construction features, but those of lighting, machinery and all other parts, were described in detail. This paper provoked a great deal of discussion, indicating that members of the Western Society were interested in the bridge not only from the technical point of view but from the viewpoint of the interested citizen. The meeting was adjourned at 9:30 p. m.

Meeting No. 1075, April 15, 1920.

This was a joint meeting of the Mechanical Section, Western Society of Engineers and the Chicago Section, American Society of Mechanical Engineers, Mr. G. R. Brandon, presiding. There were 83 members and guests present. Prof. Bruce Benedict, Director of the Shop Laboratories, University of Illinois, presented a paper on "Teaching Shop Executives." This was illustrated with lantern slides and was of interest to industrial engineers and executives as well as mechanical engineers. The shop laboratories of the University are operated by the engineering students, Prof. Benedict explained, under the supervision of the faculty. They receive training in all branches of shop management, from the workroom to the executive's chair. They are required to turn out certain amounts of material under contract and thereby operate in a practical way. Prof. Benedict said, that it was the purpose of the University, as soon as possible to have members of the engineering classes put in their vacation periods in practical engineering experience and asked the co-operation of the Western Society with the University so that they might find employment for as many of the young men as possible. The meeting was adjourned at 9:30 p. m.

Meeting No. 1076, April 19, 1920.

This was a dinner meeting at the Hotel La Salle for members of the American Society of Civil Engineers, the American Institute of Mining and Metallurgical Engineers, the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the Western Society of Engineers on the occasion of the contemporaneous meetings of the Governing Boards of the Four Founder Societies in Chicago. Mr. A. S. Baldwin, a past president of the Western Society, presided. He first introduced Mr. Arthur P. Davis, president of the American Society of Civil Engineers. Mr. Davis declared that there must be a more complete federation of engineering societies for the public good. Herbert Hoover, the president of the American Society of Mining and Metallurgical Engineers, who was unable to be present, was represented by Arthur Thatcher of St. Louis, a director of that organization. Fred J. Miller said that the engineer should endeavor to acquaint the general public with his activities and general mission in life. Mr. Miller is president of the American Society of Mechanical Engineers. Mr. Calvert Townley, president of the

American Institute of Electrical Engineers declared that the engineer has never learned the value of team work. The American public cannot, and does not want to, get along without the services of the engineer. Dr. Theodore G. Soares of the University of Chicago said that the engineer's mission was to play an important part in the public affairs of our government so that the people might be led aright. There were 325 members and guests present. The meeting was adjourned at 11 p. m.

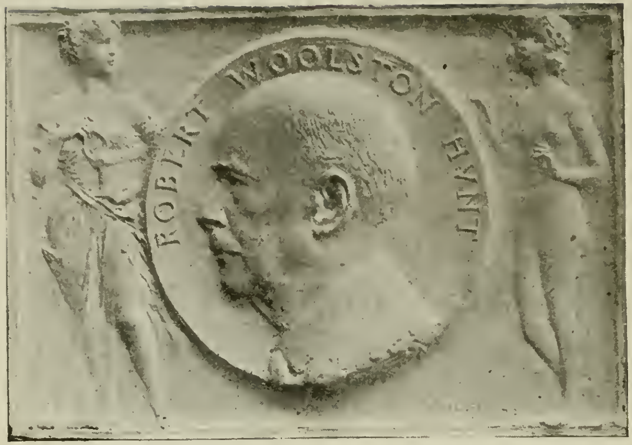
Edgar S. Nethercut, *Secretary.*

Notice—Society Badges

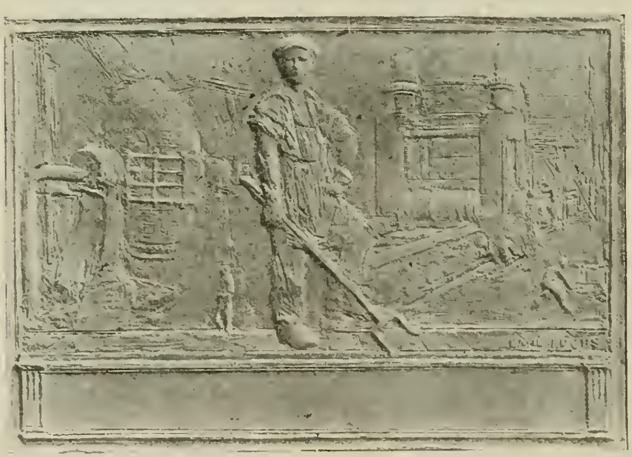
THE Officers of the Society have succeeded in making a more advantageous arrangement for the manufacture of our Society badges than we have heretofore had, and the Society is now able to furnish them to the membership at the following prices:

Gold badge, with blue enamel, for Members and Associate Members . .	**$3.00**
Silver badge, with green enamel, for Junior Members and Affiliated Members	**$2.00**

SHOW YOUR LOYALTY BY WEARING THE BADGE



Obverse side



Reverse side
Robert W. Hunt Medal

CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV MAY 20, 1920 Number 10

New Section Organized

The seventh technical engineering section of the Western Society has been organized. On May 24, about 60 members of the Society met and elected Frank F. Fowle chairman of the new section—Telephone, Telegraph and Radio—Stanley R. Edwards, vice-chairman; Montford Morrison, Morris A. Frye and Fred L. Baer, directors for three and two years and one year, respectively. Regular section rules were adopted without debate and the time of meeting set as the first Tuesday in each month, excepting July, August and September.

Fred L. Baer, sales engineer of the Automatic Electric Co., presented a paper on "The Transition from Manual to Automatic Switching of Telephone Traffic in Large Metropolitan Networks," illustrated with a number of interesting lantern slides.

There was a short discussion of the paper following Mr. Baer's presentation.

Correction

In the Journal of May 5 it was stated that F. H. Cenfield, Assoc. W. S. E., was acting mayor of Chicago during the recent absence of Mayor Thompson. This statement was erroneous and is regretted by the Editor.

Excursion to Madison

Nineteen members and guests of the Western Society went on the excursion to Madison. Arriving at 7:20 A. M., May 28, the party was met by Mr. Muther, general sales manager, Gisholt Machine Co.; C. V. Maudlin, Forest Products Laboratory, and Dean F. E. Turneaure, College of Engineering, University of Wisconsin. Breakfast was served by the courtesy of the Gisholt Machine Co. and then automobiles were provided for the trip to the company's plant. The trip was made by the way of the third lake shore line.

On arrival at the plant four parties were formed and, with guides, were shown the facilities of the plant. The Gisholt Machine Co. manufactures turret lathes, planers and boring machines, both manual and automatic, being pioneers in this work. In addition to this they have developed the productograph by means of which all cost records are kept. The success of this device has led to its introduction in other industries. Photographs were taken of the group before leaving the plant.

The State Capitol power house was next visited. Here all electrical power and heating for the capitol is generated, the plant being connected to the administration building by means of a tunnel. The plant is well equipped with all modern devices for the economical generation of power.

Mr. Blumenfeld, Superintendent of Public Property, met the party at the State Capitol, where the W. S. E. members had the privilege of meeting Governor E. L. Phillips. A very capable guide was provided and the important rooms in the capitol were shown to the party with a full description of construction, materials and decorations. The dome of the building was visited from which an excellent panoramic view of the city can be obtained.

Luncheon was served in the Capitol Cafe through the courtesy of the Gisholt Co.

From the Capitol the party proceeded to the Forest Products Laboratory, enroute visiting the parks and other grounds provided by the city of Madison. At the Laboratory a test was made of a box girder member of an airplane, tested under vertical load with horizontal thrust. Other departments of the laboratory were inspected. A clear idea was obtained of the activities of the Forest Product Laboratories in developing the scientific knowledge pertaining to the uses of wood.

Dean Turneaure and his assistants took the party in charge and the next stop was made at the University Engineering School. The work of the school was explained and the various engineering laboratories visited.

Although not attended by anything like the number of members that was expected, those who did attend probably had a better opportunity of enjoying the trip than if a larger number had taken the trip. The opinion of those present was that those who failed to attend missed one of the most interesting excursions that the Western Society has ever prepared. The arrangements for this meeting were in the hands of the Excursion Committee of the Society, Cass Kennicott, chairman.

Armour Branch W. S. E.

The following is reprinted from the May issue of the *Armour Engineer:*

"As the semester draws to an end, the Armour Branch of the Western Society of Engineers can proudly state that it has passed through a very successful period of infancy. We have a membership of 45 men, all of whom have shown an active interest in the affairs of the Society. The Western Society of Engineers, the parent body, has co-operated with us in every possible way and through the kindness and courtesy of its officers we have been able to secure several prominent engineers for our talks.

"On March 15th, Mr. E. E. Perkins, consulting engineer, gave a short talk on 'Evaporation,' followed by a general discussion. Mr. Perkins emphasized the fact that an engineer must have a thorough knowledge of Physics, if he expects to reach the top of his profession. Some of us rather overlook the above fact and attempt to sleep through Prof. Wilcox's classes. It is to be remembered that some things count for more after we have left school than they seem to while we're daily customers.

"Not very long ago the electricals were boisterous over the fact that Prof. Steinmetz honored the Institute by his presence. On March 29th, Mr. T. L. Condron, chairman of the Joint Committee, gave us a fine lecture on "Reinforced Concrete in Building Construction." Although the lecture was well advertised beforehand, the attendance was not as good as was expected. The subject as presented by Mr. Condron was of interest to other students than the Civics and it is hoped that in the future when our program is of a general nature that more of the other fellows will attend.

"Almost to a man we have been on inspection trips on an average of every odd Wednesday in the month. The following places have been visited within the year:

"Morava Construction Co., Packard Motor Co. building construction, Michigan Avenue Bridge, Franklin Street Bridge, New John Crerar Library Building, Armour's Northwestern Elevators, New Drake Hotel, American Bridge Co., American Tinplate Co., Portland Cement Co., and A. R. E. A. convention and show.

"The society intends to hold a sort of farewell smoker before school closes. The date cannot be announced as yet but the social committee is working on the details. The participating members should remember that they soon will be active and that there must be more participating members to take the places that they leave vacant. Therefore get hold of the freshmen who will soon be sophomores and talk Western Society to them, bring them to the smoker and make them feel that they simply must get in with the regular bunch, the W. S. E. fellows."

The present officers of the Armour Branch are: President, R. M. Singer; vice-president, G. C. Kumbera; treasurer, G. W. Peterson; secretary, W. K. Lyon, Jr.

A. I. M. E. Receives Hunt Medal Award

What proved to be one of the most unique gifts in the history of the engineering profession was conceived by the employes and partners of Robert W. Hunt and Company, with headquarters in Chicago.

In former years it has been the practice of the company to tender a dinner to Captain Robert Hunt on the occasion of his birthday. When he reached the fourscore mark there was a banquet at the Blackstone Hotel.

But those responsible for these affairs felt that something more substantial and of a more permanent character should be given to Captain Hunt in recognition of his services to the steel and iron industry and of his attitude toward his associates in the company.

Captain Hunt is a member and past president of the American Institute of Mining and Metallurgical Engineers and has devoted much of his time to the upbuilding of that organization, of which Herbert Hoover is now president. The Western Society is also honored by having Captain Hunt as a past president.

A committee of employes was appointed and it was determined to provide a permanent memorial. A medal fund of $7,500 was subscribed by the members of the company and this was presented to the American Institute of Mining and Metallurgical Engineers, the income from which is to be used as a basis of awarding a prize to the engineer contributing to the Institute the best paper or papers on iron and steel.

The Iron and Steel Committee of the Institute decided that the first medal should be awarded to Captain Hunt himself.

The formal acceptance of the fund and the presentation of the medal was made in New York at the Engineers' Club, May 27. Captain Hunt was in attendance and the provision of the company came as a complete surprise to him.

A. A. Stevenson, acting chairman of the Iron and Steel Committee of the Institute, presided at the dinner. The medal fund was formally presented to the Institute by John J. Cone of Robert W. Hunt and Co. President Hoover made the acceptance and briefly outlined the purposes of the medal fund.

Charles M. Schwab delivered an address on "Robert Woolston Hunt —The Man," paying tribute to the qualities which Captain Hunt has displayed in his association with the leaders of the steel and iron industry. Captain Hunt made a brief response after the presentation of the medal. Following the dinner a reception was held for Captain and Mrs. Hunt. It was said that it was the largest gathering that was ever in the assembly room of the Engineering Societies Building.

The terms of the award are:

1. The award shall consist of two prizes; first of a gold medal, second of a sum of money, a certificate to accompany each prize. The money prize shall not be awarded to a member over 40 years of age, but under unusual circumstances both prizes may be allotted to one person provided he is not over 40 years of age. In general it will be understood that the committee shall award the money prize to the younger men, rather than the medal.

2. The awards be made not oftener than once a year to that person or persons contributing to the Institute the best original paper or papers on iron and steel. The scope of the term "Iron and Steel" shall be determined by the sub-committee considering the awards. In general, papers dealing with the practical side of the subject have preference over those dealing with the theoretical side, in recognition of the fact that Captain Hunt's main contributions to the industry have been in the improvement of production and the quality of material.

3. A sub-committee of three to five, including the chairman of the Iron and Steel Committee, be appointed by the Iron and Steel Committee annually to adjudge the award subject to approval.

4. The awarding committee submit its report to the Iron and Steel Committee at its October meeting, and the award be certified to the Secretary of the Institute in time to permit the presentation to be made at the annual meeting of the Institute.

5. The recipient of this award shall be designated the "Hunt Medallist."

U. S. Chamber of Commerce Elects Engineers

Two members of engineering societies were elected to the board of directors of the Chamber of Commerce of the United States at its recent annual meeting in Atlantic City. These two men are Howard Elliott, member of the American Society of Civil Engineers and chairman of the board of directors of the Northern Pacific Railroad, and L. B. Stillwell, past president of the American Institute of Consulting Engineers and of the American Institute of Electrical Engineers. Mr. Stillwell has a consulting electrical practice in New York.

Chicago Electric Club Moves in New Quarters

On the mezzanine floor of the Hotel Morrison, the Chicago Electric Club—said to be the largest single industry club in the United States—has taken up permanent quarters for its 800 members. With the exception of a gymnasium and swimming pool, there are practically all the accommodations of the first class clubhouse.

The hotel provides service in the club dining room and arranges for hotel reservations, theater tickets, dinners and dancers for the members. This has brought about a large increase in the number of non-resident members.

On Tuesdays the club holds its weekly luncheon in the main dining hall of the hotel and on other days about 100 members are served in the private dining room of the club.

The present officers of the club are: C. W. PenDell, president; Walter E. Bishoff, first vice-president; Paul A. Westburg, second vice-president; A. G. DeClercq, secretary-treasurer; Paul W. Koch, chairman, house committee. Harry A. Porter, Paul W. Koch, C. H. Roth and Harry V. Coffy compose the board of managers.

New Code of Ethics Planned

A new proposed code of ethics was discussed at the semi-annual meeting of the American Society of Mechanical Engineers at their meeting in St. Louis, May 24 to 27. This code is to be prepared by mechanical engineers but is proposed to service as a basis for a code for the entire engineering profession.

Final action on this proposal will be taken at a later meeting of the Society.

May 20, 1920

Water Power Conservation Bill Approved

Of interest to engineers is the announcement from Washington that the compromise water power bill approved recently by the House and Senate has been sent to the President for his signature.

The bill provides for the development of the nation's water power on conditions which safeguard public interests. Special provisions are that a commission shall be appointed to supervise the development of water power of navigable rivers under licenses granted to individuals and corporations. The prior right to develop power belongs to the government, and upon expiration of a license held by private concerns the government reserves the right, according to the bill, to take over any of the power property, paying not more than the original cost. The government also reserves the right to operate the plants in time of public danger, and take over the power property under condemnation proceedings.

Construction of plants is to be under the full supervision of the government. Projects must be begun within two years and completed within a time named by the Water Power Commission under penalty of cancellation of license. The regulation of service rates is left to states and municipalities, but the Commission supervises financing of power corporations. The instability of the coal and fuel oil situation makes this development of water power of paramount importance to national industries. Scientists and engineers have stated that American oil deposits will be exhausted in twenty years, and therefore some substitute must be provided for fuel oil.

The United States Geological Survey estimates that fifty-four million water power horse power is available for development in this country, but, according to figures recently issued by the Department of the Interior, only about six million horse power is utilized continuously. Therefore, it can readily be seen that nation wide development of hydro-electrical power will result in the upbuilding of industry and an increase in production.

It is interesting to note that Mr. Samuel Insull, speaking before the first noonday luncheon of the Western Society, remarked "that if all the water power of the United States could be made available, it would not be sufficient to meet the demands for energy." It would seem then that the future policy of the government should be to utilize American water courses to their fullest extent, supplementing the power derived with that obtained from coal and oil.

Central Electric Station Industry in Canada

Electrical energy, through its ease of transmission and its broad adaptability to domestic, industrial and commercial use, has become of paramount importance to our modern life. The generation of electricity, dependent in the greater part upon coal and water power, has offered outstanding advantages to the efficient utilization of the latter, and Canada has been quick to appreciate the peculiar advantages possessed by her strategically located water powers and to realize in their development for hydro-electrical purposes, one of her greatest natural resources. In this development the central electric station industry has played a most important part, and in view of its exceptionally rapid development, particularly during recent years, a record of its present standing is of special interest.

The Dominion Water Power Branch, Department of the Interior, in co-operation with the Dominion Bureau of Statistics, is publishing an analysis of the results of the second census of central electric stations in Canada, showing the status of this important industry at January 1, 1919. The report includes statistics relative to central electric stations only, as defined for census purposes, i. e., stations which sell or distribute electrical energy for lighting, heating or general power purposes, other than that generated by industrial organizations for their own direct use in the operation of some other industry. The statistics therefore treat only with the generation and distribution of electrical energy insofar as such energy is not used directly by the station reporting. In each case where the central electric station operations are combined with those of some other industry, special care was taken to secure statistics relating only to that part of the operations which are chargeable solely to the central station activities.

The central electric stations are divided into two fundamental classes, generating stations which include stations generating all or part of the power they sell or distribute, and non-generating stations which purchase from some other station all the energy they sell or distribute. The analysis further divides the stations according to ownership and type of power used, into the following classes: municipal, commercial, hydro-electric power and fuel power stations. The statistics are given for the Dominion as a whole and by provinces. The analysis has just been completed and the following brief summary of the statistics has been prepared:

The total number of stations reporting is 795, of which 515 or 64.8 per cent generate their own power and 280 or 35.2 per cent are of the non-generating type. The commercial stations numbered 377 and the municipal stations 418. Of the generating stations 332 are commercial and 183 municipal, while of the non-generating stations 45 are commercial and 235 municipal. As noted in the results of the last census the system of the Hydro-electric Power Commission of Ontario, with its extensive distribution, selling blocks of power to local municipal commissions, accounts for a large proportion of the municipal non-generating stations.

The aggregate capacity of all primary power machines reported is 1,958,642 horse power, of which 1,841,114 horse power is installed in main plants and 117,528 horse power in auxiliary or stand-by plants. Of the total for the main plants 1,434,196 horse power or 77.9 per cent was reported by commercial stations and 406,918 horse power or 22.1 per cent by municipal stations, while of the auxiliary plant equipment the former accounted for 110,853 horse power and the latter 6,675 horse power. According to source of power the total for all prime movers is divided as follows: from water 1,682,191 horse power, from steam 262,562 horse power, and from gas and fuel oil 13,889 horse power.

The average primary power installation of the main plants per thousand population for the Dominion is 209 horse power.

The extent of Canada's water power resources, their availability to industrial centers and their adaptability to the central electric station industry is reflected to a marked degree in the statistics presented in this report. Hydro-electric power is now served to practically every large industrial center in Canada and the rapid extension of the large distribution systems together with the active hydro-electric construction at present in progress is fast linking up the few centers which have hitherto derived their power from fuel. In considering the extent to which water is used as a source of primary power in this industry, it is of interest to note that according to a recent census of developed water power in the Dominion 72.7 per cent of the total is utilized in connection with the central electric station industry.

Of the aggregate capacity of all prime movers installed in the main plants 1,682,191 horse power or 91.4 per cent is derived from water, and including the prime movers of auxiliary or stand-by fuel plants the hydraulic installation represents 85.0 per cent of the total.

In Ontario, Quebec, British Columbia and Manitoba the steam plants which are auxiliary to hydro developments account for 113,350 horse power or 69.2 per cent of the total steam power installation for these provinces. For the Dominion as a whole there is installed in connection with hydro-electric developments 117,198 horse power in auxiliary fuel plants.

The total number of persons reported as employed in the central electric station industry in Canada is 9,696 with salaries and wages aggregating $10,354,242. Commercial stations employed 5,690 persons at $6,137,525 and municipal stations 4,006 persons at $4,216,717. The total number of persons employed in the industry averages 5.2 per thousand installed primary horse power, while the aggregate salaries give an average of $5.62 per installed primary horse power.

JOURNAL
OF THE
WESTERN SOCIETY
OF
ENGINEERS

"To promote and advance the science and art of engineering."

Civic Problems

The Michigan Avenue Link Bridge was formally opened to traffic May 14th. The construction of this bridge was made possible through the activities of engineers in developing the art of bridge construction to its present high plane. However, there was a considerable lack of recognition of the engineering profession in the ceremonies attending the opening of this bridge.

Engineers at the present time have great opportunity for a larger service to the community than that of applying their technical skill to similar problems. The successful completion of this important civic accomplishment started with the conception of an idea. Many citizens contributed liberally to the promotion of this idea when conceived, but the services which the engineering profession has rendered in this project were not conspicuous. The members of the Western Society of Engineers can do a large service to the community by giving thought to the projects of municipal improvement which are essential to the progress of the city. Laymen will assist in this, but the leadership of our Society is possible.

There are many problems which need our attention, among these may be mentioned urban transportation, city planning, terminals—rail and water, and inland waterways. Committees of the Society are actively engaged in studying these problems. There is an opportunity for all members of the Society who are interested to join these committees and assist in the study. Consider this an invitation to join one of these groups. Or, if you have in mind another problem which the Society should consider, please register your suggestion promptly.

Activities on the part of the Society in these questions will, in the first instance, assist in their proper solution and will be a distinct public service; secondarily, it will tend to greatly improve the status of the engineer in the public mind.

M. I. T. Co-operative Plan Proves Success

For the past year an interesting experiment in co-operative engineering education has been conducted by the Massachusetts Institute of Technology and the General Electric Company. While the co-operative scheme in itself is not new, several departures from the usual plan were introduced, which have produced decided results.

The class was limited to thirty students, who were chosen entirely upon the records which they had made in the equivalent of the first two years' work of the Electrical Engineering Course at Technology. Included in this group were graduates from Yale, Harvard, Dartmouth, Princeton, the Naval Academy, besides men who had completed their first and second years solely at Technology. The year (12 months) is divided into four three-month periods, the students spending alternately thirteen weeks at the Lynn works of the General Electric Company and eleven weeks at the Institute, followed by a two weeks' vacation. The group at Lynn is housed together in a fine old residence which has been converted into a modern club house. No break is made in the major studies when the students are at Lynn,—classes being conducted at the Works in Principles of Electrical Engineering and in General Studies. The progress of the students through the plant is regulated, not by the production needs of the various departments, but by the advantage which the experience in each department is to the students.

The results of this year's work have been gratifying to the originators of the plan. Because the students were a selected group, were all taking the same course, and were thrown together intimately at work and at the club house, an intense spirit of loyalty to one another, to the Institute and to the General Electric Company soon became manifest and every man strove to make a reputation for the course. With the students attacking the work in this frame of mind, it is not surprising that their enthusiasm was soon shared by the officials and superintendents of the co-operating company, who are unanimous in stating that the work done in the shops has been pre-eminently satisfactory. As evidence of its approval of the work, the company has increased the number of men who can be enrolled in this year's class to sixty and has already secured a new club house in order to furnish rooming accommodations for them. The new class which has already nearly completed its quota of members will enter upon the work July 6.

EMPLOYMENT SERVICE

NO CHARGE is made for opportunities announced in this section of the Journal.

ANNOUNCEMENTS must not be more than sixty-five words in length and will not be inserted more than twice during a period of two months, during which time all records will remain in the active files. All correspondence will be treated confidentially.

APPLICANTS for situations, not members of the W. S. E., must have card of introduction from a member of the Society.

ALL REPLIES should be addressed to the key number indicated, in care of Employment Bureau, Western Society of Engineers, 1735 Monadnock Block, Chicago.

SITUATIONS WANTED.

B-601: YOUNG MAN WITH exp. in laboratory or heat treatment of steel with large eastern company desires position in laboratory or steel plant where past exp. will be of value.

B-602: COMPETENT OPERATING and construction engr. with sales exp. will consider opening along above lines.

B-603: U. OF ILL. GRAD. ELECT. engr. 1915, exp. in automatic telephony and general appraisal desires position with appraisal concern or in commercial engr. field.

B-604: ENGR., 12 YRS. EXP., designing, construction and executive work, familiar with machine design, elect. generating & distributing systems, gas and waterworks and oil refinery plants, wants position as mech. engr. or executive asst.; best of references.

B-605: ENGR. WITH EXP. IN production work, machine layout and supervision of architect's plans, having knowledge of purchasing & installation of machinery and equipment is open to offers of similar character.

B-606: C. E. GRAD.; SINGLE, age 31; desires position as field engr. on construction work; 12 yrs. railroad, dam, canal, hydro-electric construction and location. Former capt. engrs., A. E. F.

B-607: YOUNG MAN WITH bldg. constr. exp. desires position in same field.

B-608: DRAFTSMAN FAMILIAR with refrigerating machinery and architectural plans desires position in Chicago territory.

B-609: POWER SALES ENGINEER, grad. E. E., 5 yrs. exp. in industrial power work, with industrial concerns and public utilities. Desires permanent connection with aggressive new business dept. of public utility. Would consider connection with manufacturer of elect. machinery.

B-610: ARCH. ENG. LONG EXP. in design and construction of timber, steel, reinforced concrete office, store, factory bldgs. desires connection with bldg. material supply company or contracting firm.

B-611: YOUNG MAN, 25, WANTS position in industrial concern; 2 yrs. college, C. E., 2 yrs. railroad maintenance and valuation; 9 mo. tin mill construction.

B-612: MECH. ENGR., 28, 11 YRS. exp. in machine design; shop and foundry practice; plant layout and industrial management and control, wants position in same kind of work.

B-613: MECH. ENGR., WANT position where general mechanical ability is required. 4 yrs. experience.

SITUATIONS AVAILABLE.

A-61: WANTED—3 COMPETENT draftsmen for design and construction of locomotive coaling stations and coal tipples. Salary according to ability. Position permanent. Also 2 good tracers on structural and machanical drawings.

A-62: MECH. DRAFTSMAN, with exp. in designing boiler plants, including coal handling apparatus, wanted. Chicago territory.

A-63: TWO MECH. INSTRUCTORS for southern university, term begins in fall. Good chances for advancement for right men.

TECHNICAL SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

VOLUME XXV MAY 20, 1920 NUMBER 10

Secondary Technical Education

By GRANT BEEBE, M. W. S. E.,
Principal, Calumet High School, Chicago.

Presented April 5, 1920.

TECHNICAL education in schools of a grade below College and University, owes its existence largely to the work of Professor C. M. Woodward of Washington University, St. Louis. In 1880, encouraged by the success of Shop Work and Drawing, which had been introduced in Freshman Engineering Classes, he became convinced that there were a large number of boys who possessed a taste for Mathematics and Mechanics, but who were not attracted by the High School work as then offered.

With the assistance of a number of wealthy citizens of St. Louis, he organized the Manual Training School of Washington University. The school was so named because of the desire to emphasize the fact that an attempt was being made to give special hand training, with the purpose of overcoming the gap that so frequently exists between thinking and doing, and between theory and practice. Its motto was, "Put the whole boy to school." Up to this time the Secondary Schools of this country had been modeled on the old Academy, which was organized and maintained for the purpose of preparing students to enter the Universities and Colleges which were, themselves, modeled after the professional and classical schools of Europe.

These Academies, therefore, had a course of study which embraced Greek, Latin, English, Modern Language, Mathematics, and a little Science and Freehand Drawing. It is a proof of Professor Woodward's breadth of outlook, that, having had an education of the older type (being a graduate of Harvard and no mean scholar of the Classics), that he should appreciate the fact that there were many young men who did not find an opportunity for development of their talents in any purely academic school.

It was his intention to offer a course of training, which would appeal to the pupils who were daily drifting out of the grammar schools to prepare themselves for mechanical work in later life, through experiences in shops or engineering offices, getting what help they could from those who were immediately above them, or from private instruction. It was the intention to offer a training of high school grade where the immense amount of time and effort, which had previously been given up to Latin and the Foreign Languages, might be expended on work of a practical character. It was also the intention to enable boys taking this course to be prepared to take their places in industry at the earliest possible moment and, therefore, the course was made three years.

There was another reason for the three year course. In his analysis of industrial operations, Professor Woodward decided that there were three main divisions of industry; First, those industries where wood was the main material; second, those where metal was formed by the process of forging and founding, and third, where metal was finished in the required forms by the use of machines. This gave at once a very simple and efficient outline of work, presuming that the academic work should cover English, Science, and Mathematics, and the shop work should cover Carpentry, Forging and Foundry Work, and Machine Shop, and that all should be accompanied by a course in Mechanical Drawing.

The school was an immediate success, and attracted attention from Maine to California. Its course of study was made the model for hundreds of similar schools all over the country and thousands of boys who found little to attract them in the academic type of high school, thronged eagerly to the Manual Training Schools.

The course of study given in these schools with the time schedule is given below:

First Year—

English—5 hours per week.
Biology, Physiology or History—5 hours per week.
Algebra—5 hours per week.
Wood Shop—10 hours per week.
Drawing—5 hours per week.

Second Year—

English—5 hours per week.
Physics—5 hours per week.
Plane Geometry—5 hours per week.
Forging and Foundry—10 hours per week.
Mechanical Drawing—5 hours per week.

Third Year—

English—5 hours per week.
Chemistry—5 hours per week.
Solid Geometry and Trigonometry—5 hours per week.
Machine Shop—10 hours per week.
Mechanical Drawing—5 hours per week.

If all the pupils taking this course had wanted to go immediately into industry, no modifications would have been necessary,

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for while the amount of general culture offered was not equivalent to that given in the academic high schools, it enabled the graduates to establish themselves in satisfactory positions in a rather short time. The time given was six full hours; school beginning at 9 o'clock and closing at 3:30, with half an hour for lunch, all study having to be done outside of school hours.

If, however, graudates from these schools wished to enter a college or engineering school they were obliged to take two years of Language not provided for in the course. This, and the consideration that the age of the high school entering students was lowered by more efficient teaching and supervision in the lower grades, made it desirable to extend the course to four years. This has resulted in the Technical Course that is being given in many high schools today.

About 1907, the rapidly expanding industries of the country demanded more and more of the boys who had received this type of training, and they were also demanding that the training be more specialized and put in closer touch with the industries. In other words, more emphasis was laid on the industrial, rather than on the cultural feature.

I believe that Mr. W. J. Bogan, then recently appointed principal of the new Lane High School, can claim the credit of selecting the word "Technical" to designate this new type of school and the Lane Technical High School, so far as I know, was the first of this type. The word met with immediate acceptance and now is used all over this country, to indicate a school giving more or less specialized training in the work relating to the industries.

In Chicago, we have three schools devoted exclusively to the instruction of boys in the following courses:

Four Year Technical Course, Four Year Architectural Course, a Two Year Course in Mechanical Drawing, a Two Year Course in Machine Shop Work, a Two Year Course in Electricity, and a Two Year Course in Printing.

Two examples of these courses are given below:

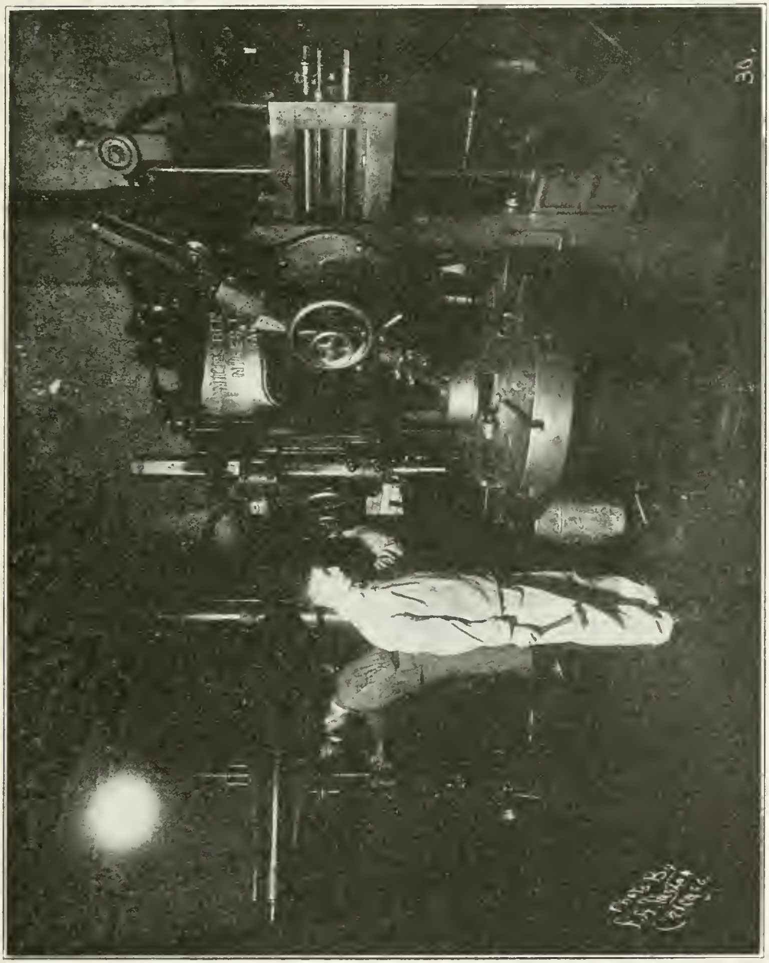
FOUR YEAR TECHNICAL COURSE.

First Year—

Wood Working—7 hours per week.
English—3¾ hours per week.
Algebra—3¾ hours per week.
Physiology—3¾ hours per week.
Mechanical Drawing—3¾ hours per week.
Pattern Making—3¾ hours per week.
Physiography—3¾ hours per week.

Second Year—

Founding or Forging—7½ hours per week.
English—3¾ hours per week.
Geometry—3¾ hours per week.
Mechanical Drawing—3¾ hours per week.


30.

Choose one Elective each semester from the list below: .

Foreign Languages—3¾ hours per week.
Botany—5¼ hours per week.
Zoology—5¼ hours per week.
Industrial History—3¾ hours per week.

Pupils who intend to take a University course should take one and the same foreign language throughout two years as an Elective.

Third Year—

Machine Shop—7½ hours per week.
English—3¾ hours per week.
Advanced Algebra—3¾ hours per week.
Physics—5¼ hours per week.
Freehand Drawing—3¾ hours per week.
Solid Geometry—3¾ hours per week.
Drawing—3¾ hours per week.

Fourth Year— .

*Shop—7½ hours per week.
English—3¾ hours per week (20 weeks).
Chemistry—5¼ hours per week.
Drawing—3¾ hours per week.
Civics—3¾ hours per week.
Trigonometry (Optional)—3¾ hours per week (20 weeks).

Music and Physical Education is optional throughout the course.

At the beginning of the third year, pupils must select studies required for colleges which they are to attend.

TWO YEAR COURSE IN ELECTRICITY.

First Year—

Elementary Physics and Drawing—7¼ hours per week (20 weeks).
Wood Shop—7¼ hours per week (20 weeks).
English—3¾ hours per week.
Mathematics—3¾ hours per week.
Mechanical Drawing—3¾ hours per week (20 weeks).
Elementary Electricity—7¼ hours per week (20 weeks).
Science—3¾ hours per week.
Physical Education—2¼ hours per week.

Second Year—

Applied Electricity—7¼ hours per week.
English—3¾ hours per week.
Geometry—3¾ hours per week.
Forging or Founding—7¼ hours per week (20 weeks).
Freehand Drawing—3¾ hours per week (20 weeks).
Mechanical Drawing—3¾ hours per week (20 weeks).
Industrial History—3¾ hours per week (20 weeks).
Physical Education—2¼ hours per week (20 weeks).

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* Under advice of the principal the pupil may choose the kind of shop work best adapted to pupil's need.

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Photo By
F.A. Taylor
Chicago

The two year courses are intended for those boys who enter from lack of means or want of inclination, do not wish to take the four year courses. They do not make the pupil sufficiently expert to enter industry as a workman and as most boys complete a two-year course at the age of 16, they have neither the physical strength nor the mental development to do a man's work.

These courses do, however, attract and hold many boys who otherwise would enter the so-called "blind alley" occupations and spend their lives in the ranks of the unskilled.

They also enable a boy on entering an office or shop to observe more intelligently, to learn more rapidly and reach the maximum of efficiency in a shorter time.

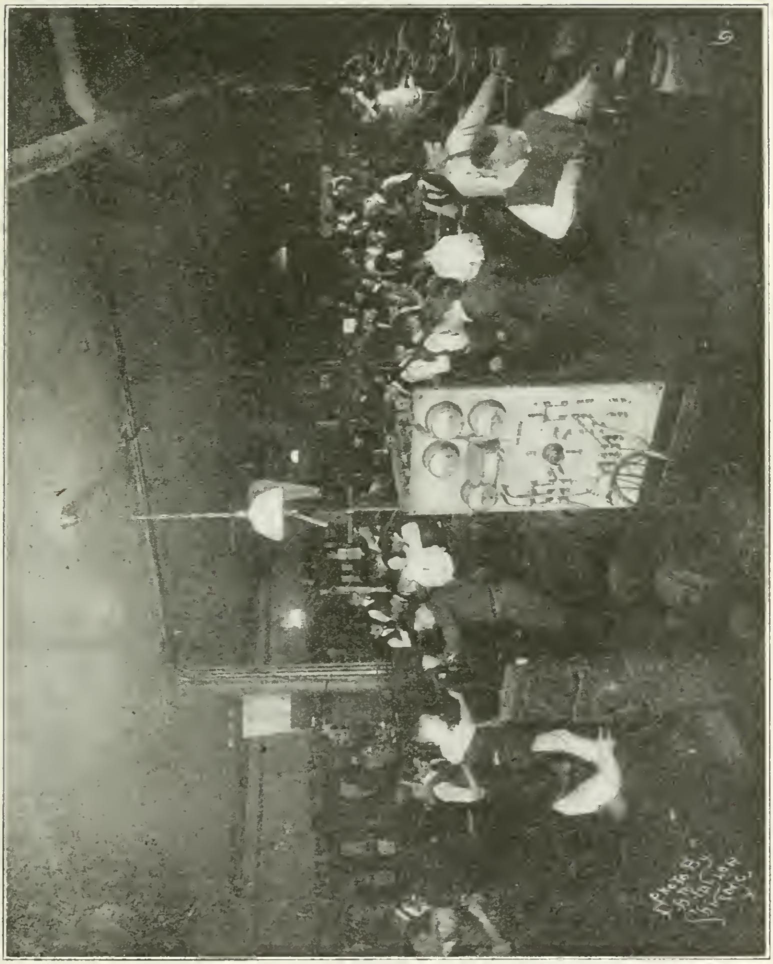
In addition to the three technical high schools for boys we have also a technical high school for girls offering four year and two year courses in Catering, Millinery, Dressmaking, Sewing and Designing. It also offers a post graduate course in Typewriting and Stenography.

The demand for the training offered in all kinds of technical work has been so great that it has been found advisable to furnish equipment and teachers for more or less of this work in all the Chicago High Schools, both day and night. Every school has at least wood work and mechanical drawing. While not strictly technical the large and increasing departments of Senography, Typewriting and Accounting furnish many pupils an opportunity for vocational training.

I have devoted this much attention to this type of school because for almost thirty years it has dominated the Secondary Schools of the United States. I have been familiar with the conditions in such schools as pupil, teacher, and assistant principal, and I have had occasion to employ graduates of schools of this type at various times and I, therefore, believe that I appreciate the advantages and disadvantages of this kind of education.

When these schools were first opened, it was believed that they would furnish in a very short time, a large number of skilled workmen and would replace the apprentice system. This did not prove to be the case, apparently for the reason that the boy who had the ability and the means to complete a course of this character, did not remain at purely mechanical work at any great length of time. He generally rose to some higher position where his practical experience and mental ability secured him better remuneration than he had been receiving before. I once had occasion to tabulate the occupations of a thousand graduates of the St. Louis Manual Training School and among them I found but one Mechanic, the rest had attained positions varying from Assistant Foreman to Chief Engineer and Corporation President. Many of the men who occupied the more desirable positions had supplemented their Secondary School work with four years in an Engineering School, but a large number had only the manual training school education.

What are the advantages and disadvantages of this type of



school as demonstrated in the past 30 years? The advantages seem to be:

1. They attract and hold large numbers of boys who are mechanically inclined and who would not have attended a high school of a purely academic type.
2. They have furnished a large number of men, who have gone on into higher engineering fields, and they have furnished a great many of the men who might be termed "the non-commissioned officers in the army of industry."
3. They have provided a sufficiently flexible training to enable their graduates to change readily from one occupation to another as varying business and manufacturing conditions have made such changes desirable or necessary.
4. They have enabled many boys to make a wiser choice of a vocation or profession than they otherwise could have made.

Against these advantages, it seems to me, the disadvantages may be summed up as follows:

1. They do not offer a mechanical training of equal intensity to that furnished by the factory or shop, and apparently, it is impossible to remedy this defect on account of the time required to become proficient in most of the mechanical operations of modern industry. If a boy in school puts in enough time on lathe work to really qualify as a lathe hand in a shop, he must lose a corresponding time from such machines as the milling machine or drill press and consequently lose that flexibility which is one of the purposes of the school to develop.
2. On account of the fact that it occupies the time between 14 and 18 years of age, it removes these boys from industry at a time when they are particularly anxious to become wage-earners and when their capacity for acquiring skill is at a maximum.
3. It is expensive because of the material required and the small number of pupils which the shop teacher can handle efficiently.
4. With the present stage of family income, it can only be obtained by a comparatively small number of boys in the community.
5. These schools have not and probably *will not* furnish many workmen for the industries.

The most serious disadvantage seems to be that the economic conditions in the majority of families prevent the boys and girls from taking advantage of the opportunities offered by the high schools. While the high school attendance has increased about 300 per cent in the last 20 years, and the grammar and elementary school attendance has increased only about 41 per cent, still only about 10 per cent of the total school attendance is in the high schools. The

figures as given in the Board of Education Report for September, 1919, are as follows:

Total School Attendance	332,832
Chicago Normal School	559
High Schools	35,719

This situation is typical of the condition throughout the country and had forced educators everywhere to seek additional means for bringing secondary education of some sort within the reach of the majority of our citizens.

The most important agency for meeting the situation is the Federal Board for Vocational Education established by Act of Congress and going into effect July 1, 1917, under the so-called Smith-Hughes Bill.

The purpose of this bill as stated by the Board in Bulletin No. 1, printed in 1917, is as follows:

"The Smith-Hughes Act provides a scheme of co-operation between the Federal Government and the States for the promotion of vocational education in the fields of agriculture, trade, home economics, and industry.

"Under this act the Federal Government does not propose to undertake the organization and immediate direction of vocational training in the States, but does agree to make from year to year substantial financial contribution to its support. It undertakes to pay over to the States annually certain sums of money and to co-operate in fostering and promoting vocational training and the training of vocational teachers. The grants of Federal money are conditional, and the acceptance of these grants imposes upon the States specific obligations to expend the money paid over to them in accordance with the provisions of the act.

This co-operation of the States with the Federal Government is based upon four fundamental ideas: First, that vocational education being essential to national welfare, it is a function of the National Government to stimulate the States to undertake this new and needed form of service; second, that Federal funds are necessary in order to equalize the burden of carrying on the work among the States; third, that since the Federal Government is vitally interested in the success of vocational education, it should, so to speak, purchase a degree of participation in this work; and, fourth, that only by creating such a relationship between the central and the local governments can proper standards of educational efficiency be set up."

The act states specifically that the money may be used:

1. For the payment of salaries of teachers, supervisors and directors of agricultural subjects and of teachers of home economcis, trade and industrial subjects.
2. The money is allotted for the salaries of teachers of agricultural subjects in any State on the proportion which its rural population bears to the total rural population of the United States.
3. The money for salaries of teachers of home economics, trade and industrial subjects in any State is allotted on the pro-

portion which its urban population bears to the total urban population of the United States.

Total Amount of the National Grants to Vocational Education.
Summary of Grants to Be Given to the States.

	A	B	C	D	
	Toward salaries for agricultural teachers.	Toward salaries for trade, industrial and home economics teachers.	For training of teachers for vocational work.	Federal Board of Vocational Education for administration, investigation, studies, etc.	Total for each year.
1917-18......	$ 500,000	$ 500,000	$ 500,000	$200,000	$1,700,000
1918-19......	750,000	750,000	700,000	200,000	2,400,000
1919-20......	1,000,000	1,000,000	900,000	200,000	3,100,000
1920-21......	1,250,000	1,250,000	1,000,000	200,000	3,700,000
1921-22......	1,500,000	1,500,000	1,000,000	200,000	4,200,000
1922-23......	1,750,000	1,750,000	1,000,000	200,000	4,700,000
1923-24......	2,000,000	2,000,000	1,000,000	200,000	5,200,000
1924-25......	2,500,000	2,500,000	1,000,000	200,000	6,200,000
1925-26......	3,000,000	3,000,000	1,000,000	200,000	7,200,000

The maximum in each case above is continued annually after 1925-26.

The money for the training of teachers in any State is allotted on the basis which its total population bears to the total population of the United States. In 1917-18 these amounts for Illinois were:

For salaries of teachers, supervisors and directors of agricultural subjects	$21,900
For salaries of teachers of trade and industrial subjects....	40,800
For training of teachers, 1917-18...........................	30,650
For training of teachers, 1920..............................	61,300

The act requires that the State shall in every case match the Federal money by an equal amount, and that the State shall pay the teachers the full amounts of their salaries and reimburse itself from the Federal funds.

The act also states specifically that no Federal money may be used for equipment and maintenance of buildings, and that the cost of any instruction supplementary to vocational education and necessary to build a well rounded course of training must be borne by the State.

Schools, departments and classes aided under the bill must be supported and controlled by the public, the instruction *must be less than college grade* and the work must be designed to prepare persons over 14 years of age for useful and profitable employment in agriculture, in the trade and industries, and in home economics.

Three types of schools only can receive aid under the bill:

1. All day schools in which half the time must be given to actual practice of a vocation on a useful or productive basis. The instruction in this special vocational work must extend over not less than nine months in the year and be not less than thirty hours per week.

2. Part time schools or classes for workers between 14 and 18 years of age. At least one-third of the sum allotted to any State must be expended for salaries of teachers of vocational subjects who are employed in part time schools or classes for workers over 14 years of age who have entered employment. This instruction may include any subject which increases the civic or vocational intelligence of such pupils. Such instruction must extend over at least 144 hours per year. Under this provision the Federal Board has ruled that instruction may be given in commercial subjects which are specifically excluded from all day and evening schools.

3. Evening schools or classes for workers over 16 years of age. This instruction must be supplemental to the daily employment.

Federal Bulletin No. 9 makes the following statement in regard to part time education:

"These earlier laws placed the responsibility for both vocational and elementary education upon the master workman, thus carrying the school work into the shop; whereas the tendency in all modern legislation is to place the responsibility for vocational training upon the educational authorities, thus carrying the shop work into the school. This can be done successfully only by a part-time school which has the heartiest co-operation from public school men willing to face the issue with constructive and open-minded thinking."

* * * * *

"The employer also must remove his opposition to the introduction of this system of vocational training. There is no longer any excuse for considering it an innovation of uncertain effect upon production in the factory. It will necessitate changes and increase administrative burdens, bringing such unaccustomed procedure as the rotation of men in a series of jobs, the shifting of men from shop to shop, the possible idleness of some machines for short periods, and various conditions more or less abhorrent to the methodical manufacturer and business man. In return for this, however, the part-time system will provide him with more ambitious and better operatives, employes preparing and prepared for advancement, capable foremen, and perhaps even assistant superintendents. Of equal importance, although not so well recognized, it will increase the interest of employes in the work of the plant, with consequent increased length of service and contentment on the job."

The State of Illinois has organized a Board for Vocational Education as required by the Smith-Hughes Law. In addition to the permissive classes of the National Law, it has passed two laws of a mandatory character which are having a very marked effect on industrial education in this State.

One of these laws requires that all school districts in which there are at least twenty minors between 14 and 18 years of age, who are not in regular attendance upon all day schools, establish part-time classes for such minors and require that such minors attend such classes. This law went into effect September, 1919, and was supplemented with a special law in regard to school attendance. This law provides that in all districts where part-time or continuation schools are established, that children in employment between 14 and 16 years of age shall attend such continuation schools for at least eight hours each week during the period such schools are in session.

'These two laws provide for the gradual inauguration of a State wide system of compulsory part-time continuation schools.

During the next two years until September, 1921, no school district is required to establish part-time schools, but in districts where such schools have been established, attendance is compulsory for all minors in employment between 14 and 16 years of age.

Beginning September, 1921, part-time classes *must* be established for the age group of from 14 to 16 in all districts in which there are at least twenty minors of such age who are not attending full time schools, and the attendance is compulsory.

In September, 1922, the law goes into effect for children of the age from 14 to 17, and in September, 1923, for all children of the age of 14 to 18.

It is not within the scope of this paper to go into details of such schools, but as they require the attendance of pupils of high school age, they will in a great measure supplement the high schools already established.

Under these laws in September of this year, seven cities in the State—Alton, Chicago, Galesburg, Moline, Peoria, Rockford and Springfield—conducted part-time classes for all people at work, and the number attending these classes was 2,516; the number of teachers was 46; and the amount of reimbursement granted to the school authorities by the State Board was $41,797.17 for one-half of the salaries of the teachers.

This instruction is of three types:

1. General part-time continuation classes, continuing the general education of the pupils.
2. Trade extension part-time classes—giving trade instruction.
3. Commercial part-time classes—giving instruction in commercial subjects.

Chicago has at the present time a part-time course for the following trades: Baker apprentices, plumber apprentices, carpenter apprentices, automobile mechanics, watch making, shoe repairing, cabinet making, machinist apprentices, and sheet metal work.

There are also commercial classes both in special schools and in connection with some of the business houses.

I have tried to indicate in this paper the great demand for the extension of education above that furnished by the Grammar School, and while there are a number of private schools where very successful work is done along these lines, it is evident that the burden of this education must fall on the public. This seems entirely just, because it is the public, both employe and employer, who will ultimately benefit.

Like all pioneer work, it requires time and experience to get all agencies for secondary technical education working harmoniously. The existing high school evidently will always supply a constant demand which cannot be met by any other type of educational extension, but they are already taxed to capacity, and it is difficult to keep their buildings, equipment and teaching staff up to the minimum requirements. It has already been found that it is extremely difficult to comply with the requirements of the Smith-Hughes Law or even our State Vocational Law in the existing high schools. First, because they are already over-crowded with pupils who are taking work as previously offered; and, secondly, because the time requirements of the Smith-Hughes Law compel those pupils working under it to put in three sixty-minute hours per day to technical work, and practically all high schools in the United States are organized on the basis of giving two forty-five to fifty minute periods to such work. This seems a comparatively small matter, but the effect on the administration of the school is that the Smith-Hughes pupils are practically isolated from those taking the other high school courses. The disadvantages of this from the educational point of view are obvious.

The second great difficulty is that, so far, neither the National nor the State Government has made any appropriation or provision for equipment of schools and shops where this new work can be given. This is in itself a difficulty which must be met at once either by national appropriation, State appropriation, or greatly increased local taxation.

In some localities the effort is being made to erect comparatively cheap buildings for the pupils taking the Smith-Hughes work, in other localities the employing firms are allowing pupils to work on the part-time plan and are furnishing class rooms and all facilities except teachers.

These seem to be only temporary expedients, and it seems necessary to secure the interest and co-operation of all those interested in any kind of industrial work before any great advance in secondary technical education is possible. Certainly everyone who has at heart the best interests of the country will be willing to offer any possible assistance to these young people who are so eagerly seeking to prepare themselves for future usefulness.

It is only by such co-operation that we can attain the American ideal, that all boys and girls in the Commonwealth shall receive an education which will enable them to become self-directing, self-supporting and self-respecting American citizens.

Secondary Technical Education

(*Continued.*)

By Edward C. Rosseter,
Principal, Tilden Technical High School, Chicago.

Presented April 5, 1920.

THE public schools have had a wonderful development in the last twenty years. I do not refer to growth in enrollment, number of buildings built or growth of that kind. I refer to the scope of the work which they undertake. The idea of a common school education provided for in our Constitution has grown, just as the Constitution of our National Government has grown and has developed as the requirements of the country in its development and growth have necessitated. We have made many things part of the public school system. There is the kindergarten, the schools for the blind, the deaf, schools for those who are born short in various ways, and the technical high schools.

Even in some elementary schools we have a department—they are called the industrial course schools—where the boys and girls, before they reach high school age, are given definite technical training in wood working, printing or in household arts and domestic science, the wood working and the printing shop for the boys, of course, and the household arts and domestic science for the girls. So the idea of what is expected of the public school system has developed and grown to an extent far beyond the ideas and the ideals of the originators of the system years ago.

In the high schools, as has been shown, we have a great variety of work and many activities. It would be a revelation to you, I am sure, to visit any of the high schools, especially the technical high schools, and see just what the equipment is and what is being done.

It was my fortune to be put in charge of one of the War Training Schools two years ago, under the charge of Major Woodworth. The young man who was to have taken charge of the school was called into the service unexpectedly and I was picked upon to be his successor. The instructions I had from the office were to "Get over there and get busy." That was on Friday. The following Monday 150 soldiers appeared and the work was planned to give those men training in auto construction and repair work that would fit them to be army auto drivers and repair men. As soon as possible I got to a meeting where we were to receive some directions from the Major. I have never forgotten the point that he made in his address to the principals and instructors. He called attention to the fact that we have on the one hand, included in the output of educational institutions, shops and factories, people who are trained to think without being called on to do very much. They come from the academic schools and the colleges, perhaps. On the other hand there are the men who are trained to do things;

they come from the farms and from the shops. What was wanted in the army, and the factor that won the war, I am inclined to think, was people who were taught to think and to act at the same time; who were able to use their own initiative; to meet emergencies; to be adaptable; to get results by going ahead and doing things.

That, I think, is the aim of the technical school. We train our young people to use their wits. They have more or less work in the class room which requires study and close application. In the shops they are taught to do things with their hands under careful supervision. But whether in the machine shop, the electric shop, the wood shop or any other, there are the boys all busy working by themselves or perhaps in groups, two or three at a place. They have had their general directions, but are told to tackle the special problem and get results. Generally they do it intelligently and that is the strong point of our technical training. It appeals to young fellows of the best type. More than that, it gets into the schools the boys who do not care about study and have to be driven with a club into the academic schools. Once started they generally get busy, find congenial occupation and take a delight in doing things.

The Tilden Technical High School has been referred to as one of the three boys' technical high schools of the city. The Crane was the original manual training school—the old English High and Manual Training—founded back in 1890. For a long time it had a small attendance. That was before people began to realize what its possibilities were. It got into its new building in 1904 and it has grown and developed until it is now a model technical high school. The Lane was established in 1907 as the technical high school for boys of the North Side. The Tilden Technical High School for many years was known as the Lake High. It had its own territory and provided high school training of all sorts, taking boys and girls from west of State Street, north of Fifty-fifth and south of the river. But now we admit boys only, but from the entire South Side. That means a radical change in traditions and ideals as well as a change in territory; we have to draw from South Chicago, from Clearing, from Morgan Park, Woodlawn, Hyde Park and all other sections of the South Side. It takes quite a while for people to realize the opportunities and the possibilities of any new enterprise. When this change was first projected it was thought there would be difficulty in getting pupils enough to fill the school, but at once we find it filled to capacity and a new building required. We are to have the advantage of being the first technical high school to be rebuilt. Crane will follow, and then Lane when they can get its new location decided upon and arranged for. In our new building we will have plenty of shop room, and will be the only technical school in the city that has sufficient. The shops in technical schools everywhere are inadequate. We shall not make the same mistake. We shall have room for many classes with plenty of equipment and machines so the boys can work without interfering with one another. We shall have no belt driven machinery. I think we have 100 or more motor driven machines in our present equipment, which will have to be trebled. We are planning for 2,500 boys. I am sure by the time the building is done we will have three thousand seeking admission. Mr. Beebe has said that the schools are all crowded. We cannot build them fast enough and as soon as a school is finished it is found inadequate. To meet this demand will cost money. The people must wake up to the fact that education cannot be had for a pittance, that the income of the School Board has to be increased very largely. We cannot have the most desirable things for nothing. We talked of spending about one million dollars a year ago on our new building. Two million would not do the work today.

There is a great future for the technical high school. The work that is being done is commendable, I am sure, but at Tilden Tech. we like to put our boys up against the real thing.

Last spring we set them to work building an electric sign on the roof. I asked for an electric sign in place of a new name panel. The Board agreed to furnish the material, and the boys, under the direction of the teachers, built it. There it stands on a frame work 16 feet high and 52 feet long with letters four feet high—TILDEN TECHNICAL on both sides—flashing out the name at night, the whole name and then off, then a word at a time, then off and repeat. The boys did that. What they are doing right now is another big thing; that is, it is a big thing for boys. Mr. Lurie, one of our drawing teachers, has furnished the drawings and computations for our aerial towers. We are putting in a real wireless outfit for our electric department. The ban on private wireless stations was taken off last October. We have receiving equipment that picks up messages from the Atlantic seaboard and are getting a Marconi transmitting outfit that will cost us about a thousand dollars. These two towers will stand on the roof, rising above it some thirty feet, with a three-inch pipe extension fifteen feet above that. The aerials will hang between the towers a distance of about 260 feet. The boys are at work on this job and will complete it in good shape. They are delighted to do work like this, they enjoy the accuracy with which the parts fit together as planned, they develop profound admiration and respect for a blue print, and with added physical vigor comes greater mental alertness and power. That is what I am trying to point out and show that we are able to turn out people who can think and do things at the same time.

The Financial Situation

By David R. Forgan,
President, National City Bank, Chicago.

Presented May 7, 1920.

THINGS happen very quickly in America.

There was an American over in my country—Scotland—not very long ago, and he was boasting of his nationality. Americans have a little reputation as boasters over there, and he was telling an acquaintance how quickly engineers and constructors could put up our wonderful skyscrapers. Finally, he told the Scotchman that in an emergency a contracting firm in New York put up a twelve story building in twelve days. The Scotchman took this all in. Soon they saw, for the first time, the wonderful Forth Bridge. As you engineers know, that is one of the engineering wonders of the world, with tremendous piers, tremendous spans; it is a most impressive bridge. The American looked at it and said, "By Gee, that is magnificent! What is that?" The Scotchman looked at it, and frowned. "I'm darned if I know. It wasn't there last night."

Fifteen months ago—January, 1919—I was in Palm Beach, Florida. I was hob-nobbing there with about half a dozen prominent men of Wall Street. They were the bluest bunch of people that I ever came across. They could see nothing in their line of business for years to come. The stock broking business was practically dead, and so on.

I am a natural optimist, and I took the other side. I said: "If I had any money now I would not be afraid to buy stocks. In fact, that is what I would do with it, if I had any." They said, "We have heard people like you before, and we will admit that usually when things look as bad as they do now, you are right in saying that that is the time to buy, but this is the time when you are wrong. Everything is going to smash."

Have you noticed anything happen in the stock market since January, 1919? There has been the greatest boom and the greatest stock-broking and security-floating campaign that the world has ever seen. And all that in only fifteen months time.

Today things are the other way in a small measure. Three months ago when a certain stock was selling at 150, a broker would have encouraged you to buy it, because it was going to two hundred. You go to that same broker today, although that same stock has earned a lot of money since, and has lost nothing, and the assets are increased by their earnings, he will not let you buy that stock at a hundred if he can help it. He will say, "Oh no; no time to buy. Everything is going down."

I am just in the same mind about things as I was fifteen months ago. I think the time is approaching, if it is not already here, when anybody with money is safe to buy.

But I did not come here to discuss the stock market. I use the stock market only as an illustration. Nineteen nineteen was a most wonderful business year. In ninety-nine cases out of one hundred, people made the greatest profits they ever made, even after paying enormous taxes. I know, because I get the statements of people in every line of business, and such is the case in general, that, after paying their taxes and with all their troubles, they made more money in 1919 than they ever did before.

Today, in dealing with different people as a banker, I find a great lot of pessimism. I find that every one who comes into my office is quite agreed that this period of higher wages, higher prices and higher profits, must certainly come to an end. They agree that there must be a great reversal of these times with regard to every business except the one that they are engaged in.

I made that remark in introducing Frank Vanderlip at a speech about a month ago, and, having made it, I thought I would test it. Since then I have been amusing myself by getting men into my office, listening to their tales of woe, discussing whether the smash was going to come suddenly or gradually,—but come it must—get them to tell me all that—and then I say, quietly, "How about your business, Mr. So-and-So?", and he proceeds to paint a picture of prosperity with regard to *his* business the like of which you never heard. He is behind in his orders, he has orders for a year ahead, and his only troubles are, of course, the general difficulties of the unrest in labor, and the delay in getting cars to ship his goods.

That is really a very peculiar situation. It has brought about a feeling among a great many people that possibly we are heading for one of our old-fashioned panics. In fact, the word "panic" is used daily now.

What did we mean by "panic" when we used to have them? We meant, in a word, *suspension*. The banks stopped paying out cash and commenced trading pieces of paper among themselves, practically suspending, while their doors were still open. It is a national disgrace that for the last century we were the only great country in the world that had these so-called panics, these suspensions of general specie payments, while the rest of the world, if they had a panic, seemed to know how to get out of it without suspension.

We went along like that, as you know, for many years. When we got through the panic we did nothing. The legislators in this country passed eighteen hundred laws one year with regard to railroads. The bankers for twenty years begged them to pass one law, or to amend the banking law, and our Congress, neither republican nor Democratic, would do it.

Finally, however, Congress passed the Federal Reserve Act. Since then I have been in the habit of saying that suspension was a thing of the past, and an old-fashioned panic, including suspension, could not happen again in this country. Perhaps that is putting it just a shade too strong, because there is a limit to everything human.

Today I am here to admit that we have very nearly reached the limit of that wonderful credit expansion permitted by the Federal Reserve Act.

Before we had it, our banks were in the position that you would be as citizens if an ordinance of the City of Chicago compelled you to keep, as a preventive against fire, one bucket of water on your premises, and then forbade you to empty that bucket if a fire should take place. We had thousands of banks, each one compelled by law to keep a bucket of reserve, each one forbidden by law to use that reserve in case it needed it.

With the inauguration of the Federal Reserve System the banks were permitted to empty all their buckets into one great reservoir, so that there is a quarter of all the gold in the world in that Federal Reserve System, as a basis for the expansion and extension of credit, which is needed when we have a war, for example, or when we are moving crops at different times of the year.

We have something now of an elastic credit system. Money and credit must never be mixed when discussing anything financial. The trouble is that we talk about credit in terms of money, and we say, "Why is money so tight? Why is there not as much today as there was six months ago? There is really more money. Then why is it possible that we should have a whisper even of a panic?" Simply because this credit expansion has taken place. It has taken place on account of a great many things. We could not foresee, when we talked about the Federal Reserve System, that we were going to enter the greatest war in the world's history. The Federal Reserve System is expanded, but over half its expansion is engaged in carrying the finances of the Government, as represented by Liberty Loans and Government Certificates. That expansion contemplates getting down to forty per cent legal reserve on the part of the Federal Reserve System against its currency liabilities—its notes—and thirty-five per cent against its deposit liabilities. Today the System has about forty-two per cent, so there is a narrow margin. But the law also says the Federal Reserve banks can go on expanding until their Reserves are only thirty-three per cent, by paying an increasing tax to the Government.

If anything worse should come upon us; if anything unforeseen should happen—some big bank fail, some Scotchman running a big bank should disappear or anything hitherto unheard of like that should happen,—we might have a feeling of panic.

But the Federal Reserve System is capable of taking care of that because the additional expansion from forty-two per cent down to thirty-three per cent by paying a little tax to the Government, and that is nothing, because all the profits of the Federal Reserve System over six per cent go to the Government. By paying that tax they can take care of several billions more expansion, if necessary, and we are not going to have any financial panic.

Just to illustrate the difference between money and credit I would like to have you follow me in this illustration, which I have used before. Let us start a bank. Let us say the capital is one hundred thousand dollars. Let us agree we will pay it in now in cash, and I am your banker. It is paid in. I will go around and see forty people, and agree to take their accounts in the bank, and to loan each of them ten thousand dollars. We will suppose the first day we open the bank that all of these forty different concerns come in and borrow their ten thousand dollars. What happens when the first one comes in? Does he say, "I have come for the ten thousand dollars," and do I go into the vault, where I have the hundred thousand dollars' capital, and take ten per cent of it and give it to him, and he walks out with it? Why no! I pick out a little slip of paper; it is all filled up except one or two places. "So many months after date I promise to pay the National City Bank of Chicago ten thousand dollars." I say, "Sign that, Mr. Smith," and he signs it—"The Smith Manufacturing Company, by John Smith." I then hand the paper to my discount clerk, who credits the Smith Manufacturing Company with the proceeds, less a little rake-off for us—so small it is not worth talking about, so leave it out of it just now.

I do that forty times, and we will suppose that happens the first day the bank is open. What have we at the end of the day? Bank statement:

ASSETS—	
Cash on hand	$100,000
Loans and discounts	400,000
	$500,000
LIABILITIES—	
Capital paid in	$100,000
Deposits	400,000
	$500,000

We have got a bank with twenty-five per cent legal reserve, and the law only asks us to hold thirteen.

It might be a little dangerous to do that in one day. If not done in one day, it takes place gradually.

A bank is a credit factory. It creates, manufactures, a currency of its own, and even when people draw checks against these credits we do not pay them in cash, because other banks are making other credits. My customers get their checks, and their customers get my checks. We send them to the clearing house, put them together, find out what the difference is, and we give a check for that, the money meanwhile remaining untouched.

In the old days when we kept that bucket of reserve—I have known this an actual fact to happen over and over again in my experience—a national bank examiner would walk in and count and weigh the reserve of gold. He would then put it back in the innermost part of the vault, and put a little paper seal over the vault door, with his signature on it. Why did he do that? Because he hoped that it was possible when he came back six months afterward that that vault, which contained the only real money in the bank (for the paper money is only credit), would be untouched. If that seal was unbroken he would not have to count it again. I have known that actually to happen. I have known the examiner to come back six months later and find the vault unopened and go away without looking at the gold.

That is the relation of money to credit, only a fractional reserve relation. That credit is a very expansive kind of thing. You people, as a rule, think of credit only as a means by which you buy and buy and pay bye-and-bye.

Credit is a much bigger thing than that. It is a kind of element closely allied to water, and so we talk about *liquid* assets, and about *floating* a liberty loan, and a liberty loan flotation, even for five billions of dollars, does not involve any money transaction except, perhaps, a few dollars some old woman had laid away in a tea-pot. The money is untouched in floating a government loan of five billions. And so you say a little syndicate is a small body of men completely surrounded by water. In this liquid sea of credit are already afloat all the bonds and stocks on all the stock exchanges in the world, all the huge national debts beyond any imagination, because of the great war, all the tremendous international trade balances, all the accounts and bills receivable on all the ledgers of the world; all these things are vessels already afloat in this sea of credit, and the only question that comes up when a Government wants another billion is—Is there room to float, at this time, another Government vessel in this sea of credit? If there is room, it can be launched and floated, and it takes no money to do it.

Our credit situation is expanded. It is expanded for many different reasons. It is expanded chiefly on account of the high price of things. That high price is said, by theoretic economists sometimes, to be due entirely to the quantitative theory of money. They rule out credit, which takes care of something like thirteen or fourteen to one times the amount of purchasing that money does. They say, because they find in periods of high prices that the money has expanded, that the expansion was due to the high prices, or rather, that the high prices were due to the expansion of credit. I have always understood that a cause had to precede an effect. To hear these economists one would think that money had been strewed on the streets first, and we came along and picked up the money and with that additional power to buy, we put prices up. As a matter of fact, they are concurrent at best. The one does not precede the other, and is not the cause of the other, although it may have an effect.

If I had to choose a side of the argument, I would rather try to prove that high prices caused the expansion of credit, than that expansion caused high prices. I never loaned a man money in my life to go out and put up the price of things, but I have loaned a man hundreds of times because the price of his commodity had gone up, and he had to have more money to handle it.

We have had the Government finance of about twenty billions. That was some vessel in the sea of credit! We have had in the last six months of 1919 an unprecedented flotation of new securities, both preferred stocks and issues of bonds, and three and five year notes. We have all these different influences, and today credit is expanded as far as it should be.

What will be the outcome? What should we do? The outcome will be all right, barring any unforeseen big national calamity, which, of course, is always possible. We might go to war with Mexico next month—for example—but, barring any big thing of that kind, the whole need is for us to act with the usual American common sense, and be a little bit conservative, each one in his own business. The Kingdom of Heaven is increased by each man coming in for himself! If you gentlemen will only preach to your companies and to everybody that this is a time, not to lose your heads, not to get frightened, not to think—we should do the last piece of business and make the last dollar we possibly can, but rather, this is the time for a little common sense conservatism, so nothing will snap, and we will get through all right. I believe we are past the peak now. I believe that with the railroads beginning to function better, we will get over the acute stage; I think the worst is over now. By all of us preaching, not pessimism, but a mild conservatism we will come through this thing gradually and safely, and prove once more that in the United States of America the worst never happens.

May 20, 1920

The Engineer's Influence in Public Utilities

By Samuel Insull, M. W. S. E.,
President, Commonwealth Edison Company.

Presented at Noon-day Luncheon, April 2, 1920.

IT is not a new position for me to be in, to talk to engineers. I might say at the start that whilst they are responsible for some of my success, I can also charge against them a responsibility for some of my failures. Still, I have sat at their feet and have listened to the wisdom they pour out, with the aid of a slide rule, and been told how to do things for a great many years, so I am more or less chastened. Under the circumstances it is quite a pleasure for me to be in a position where I can do the talking and they cannot talk back. The position is usually reversed, except where there is a case of serious responsibility to take; and, I am sorry to say it, but in a great many instances the engineer shrinks from that responsibility.

I do not know of any better plan than this one of having a series of luncheons at which you will be addressed on (more or less) the subjects of the layman, and get away from the engineering side of things. I do not know of a better experience for the engineer than this should afford him. And if he would apply the training which he receives in being educated for his profession, to the ordinary affairs of every-day life, and reason out things with the exactness that he claims to do on engineering and technical matters, the engineer would have a far greater influence than he has today in our public affairs. In times like these we are going through at present, there is nothing that we need so much as exact knowledge of the various subjects that come up before the people of a city like Chicago, or a State like Illinois, or the nation.

Take the discussion that goes on, in public affairs about local, State and interstate public utilities: it is more especially on the engineer's influence in public affairs that I am going to talk to you today.

The average politician makes the wildest kind of statements, the most absurd possible claims in relation to public utilities; and those claims have not the slightest relationship to the facts in the case. When this happens, how different would be the impression produced on the public mind, if the engineer would apply his power of reasoning to the question under discussion and would then take some pains to acquaint the public with the exact facts of the case.

Consider the absurd rubbish that political speakers have uttered when referring to the harnessing of the waters of Lake Michigan flowing down the Drainage Canal and on through to the Mississippi, and to the enormous production of hydro-electric power that would result; compare those statements—some of them put out with the authority of the then Governor of Illinois—with the results possible of achievement; and I know, if you do, that you

you will be ashamed that such statements could be made publicly without being controverted publicly by such men as are members of the Western Society of Engineers.

Now, take the great utility services: transportation, whether urban or interurban; the distribution of energy, whether by gas or electricity; intercommunication, orally by the telephone system, or by signals, as in the telegraph service. The average politician, and the average municipal officer seeking for power and patronage, will tell you that all questions relating to these services are matters of "home rule." As a matter of fact, these questions can be settled only on a state or an interstate basis, if you want real economy of production and distribution.

It is not often that I can quote from a Chicago daily newspaper to substantiate what I have to say, but I have an extract here from the Chicago Tribune of last Sunday,[1] wherein is discussed the constitution of the state, and the demand for "home rule." The Tribune says in one of its leading articles:

"Take the most conspicuous example, public utilities. We have talked much of local self-government in these utilities. But they are not local, and the whole irresistible tendency is to make them less and less local. Our transportation system is no longer local. The extension of the surburbs makes necessary communications having their terminals within Chicago and their ramifications half across the state. The city is but the center of a steadily growing network of electric lines of power for transportation and communication, trolley lines, electric light lines, telephone lines; and we are only beginning their development. In the future our power will be developed at mines outside of the city, at hydroelectric plants outside of the city. These are not local interests. The unit of organized life of which we are a part is not the city, and its control cannot be vested in the city."

A few of us have been preaching that doctrine for the last twenty-five years and the only reply to us has been that we represented "the interests," that we were engaged in great combinations, that we were doing those things for our own personal benefit, and not for the benefit of the community. It is rather refreshing to get such an endorsement from a daily newspaper which usually gives expression to such advanced ideas as the Chicago Tribune does.

My claim is that you people, from the education that you have received, from your general technical knowledge, should have reasoned out such things in years gone by, and should be the leaders of thought in a community like Chicago on subjects of this character. But my experience in years gone by, if you will permit me to say so, has been that men in my position, urging economies such as I have just referred to, would be more likely to get unfavorable criticism from a body of this character, wholly and solely because the men composing it had not taken the time to look into the fundamentals and get the necessary knowledge upon which to base a proper judgment on the matter.

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[1] Chicago Sunday Tribune, March 28, 1920.

Hence I say—having the strongest belief in the duty of every man, above everything else, to devote his abilities to the service of the state which protects him—I say that it is your duty—not alone your privilege, but your duty—the first duty of citizenship—to post yourselves on the subjects that your special training enables you to understand, far in advance of your fellows, to pass that knowledge on and to see to it that your opportunities are utilized for making yourselves a helpful influence for progress in the great community in which we live.

I do not know of anything that affects the success and the general development of a community so much as the public utilities of that community. Their treatment ,and their credit is of far greater consequence to the community in which they operate than it is to the owners of those utilities. It is fair to assume that a man, in making his investments, spreads his risk; and if he buys public utilities investments he does not put all of his eggs in one basket; that is only one of the risks he takes. But consider this great city and this great state: It is absolutely dependent upon the successful functioning of the great public utilities, whether interstate or state or municipal.

Think what it means in a country where the local public utilities alone—that is, electric light and power, telephone, telegraph, electric railroads and the manufacturing dependent on those various enterprises—have $14,000,000,000 invested and have a gross income of $3,000,000,000. The side of the business with which I have been particularly associated, the electrical business, has $3,000,000,0000 invested, and has an income of $500,000,000.

I wish to draw attention to some Chicago figures on which every engineer should be informed; and yet I doubt whether many of you in this room have ever taken the trouble to look them up. Here in Chicago, with only two and one-half to three per cent of the population of the United States, we produce, from central stations, more than five per cent of the energy distributed in the United States. By the efficiency with which our sales engineers sell our goods, we manage to get six per cent of the gross income of the light and power business of the United States. And yet we have an investment only equal to about three per cent of the total capitalization of the United States.

Or, to put it another way—and in referring to this I am referring to the Commonwealth Edison Company, and to the various local utilities in this and other communities, that it is my privilege to be connected with—we do a business of upwards of $100,000,000 a year; that is, I think, somewhere around six per cent of the total local public utility business, other than telephone and telegraph, in the entire country. We have a capitalization of about $450,000,000 to $475,000,000—about four per cent of the total capitalization of these businesses throughout the country. In other words, we manage to do $100,000,000 of business with 50 per cent less capital than the average in this class of business throughout the whole United States.

That is largely a question of the engineering of selling—that more than anything else; it is somewhat the engineering of construction, and somewhat a lack of rapacity upon the part of the man who does the capitalizing, but mostly it is the result of efficiency in the engineering of selling.

I refer, even at the risk of its being an old subject to you, to a matter submitted at a recent meeting of the American Institute of Electrical Engineers last February. It illustrates what can be done by the exercise of proper efficiency, and is very much on the lines of what we do out here in Illinois.

They took a territory extending from Boston to Washington, stretching back inland in a half circle, the extreme limit being about 150 miles, and they found in that territory a power consumption of about 17,000,000 horsepower—10,000,000 of it for industrial purposes and 7,000,000 of it for steam railroad purposes.

The present load factor, owing to the power being produced in small units for each particular business, they found to be only 15 per cent. If that entire business, that entire 17,000,000 horsepower, were operated under one organization—and there is not any reason why it should not be operated under one organization; we operate here in Illinois practically from the Keokuk dam on the west, with two or three different ownerships, to Indianapolis on the east, all through one system—from Boston to Washington and 150 miles back, you would get a load factor of about fifty or sixty per cent. Thus organized and operated, it was estimated that the 17,000,000 horsepower could be replaced by about 5,500,000 horsepower. This estimate allowed for saving only half of the fuel now used, which strikes me as ultra-conservative, yet it figured a saving of 30,000,000 tons of coal a year. At the price ruling in that part of the country, that would be a saving of $150,000,000 a year.

The proposers of this plan would operate all of the energy requirements for transportation and stationary purposes under one system; and they would pour into that system all energy produced by every means—hydro-electric, or coal, or whatever was the cheapest way to produce it. They figured they could not only save $150,000,000 a year on coal, but they could save $150,000,000 a year from other operating expenses. There are $300,000,000 a year that could be saved in that small portion of the United States by proper organization for utilization of energy.

I think it should be the mission of men like you to bring a subject of this kind home to the people of the city in which you live; to point out to them the absurdities of the political position so often taken by their public officials; to expose the great economic waste that their politicians would put on them for all time, even through the medium of a new constitution of the state, by urging "home rule" for industries which must be state wide to be efficient.

See what it would mean if the plan proposed to be carried out between Washington and Boston, which runs into such large figures because of the great density of power consumption and of transportation in that very small territory, in the distant future, if that principle could be carried out throughout this country! Or call to mind what seemed like a dream of Dr. Steinmetz a few years ago when he predicted that the day would come when the transmission system of the country for transportation of energy would, if placed upon the map of the United States, bear a strong resemblance to the great trunk lines of transportation that we have at this time stretching from ocean to ocean!

Our present national production of coal runs about 700,000,000 tons per annum. It is hardly of any use to consider anything else as a prime source of energy. If all the water-powers of the United States could be brought to locations where their power could be used, those powers would not be sufficient to take care of the existing demand for energy in one form or another. Oil cannot be considered as a source of power. The rapidly rising price, as soon as oil comes to be generally used, as it has in the last few years, is an indication that oil cannot be considered as a source of power. It is of no use to consider natural gas. That has but a short life, and we must turn to coal as the only permanent form of fuel. The future wealth and well being of this country therefore depends upon the coal supply of this country.

Whilst the United States has a greater reserve stock of coal than any country in the world, it has also a capacity to support an infinitely greater population with greater economy than it supports today. So it is fair to assume that the consumption of coal will go on increasing by leaps and bounds; and unless that coal is used with economy, used under conditions of the greatest possible efficiency, it means that future generations will have to suffer; and the end of this republic will come—away off in the distant future, of course, but it will come—from lack of coal, if for no other reason.

Using the same reasoning that has been applied by the members of the American Institute of Electrical Engineers at their February meeting, to their particular plan for the territory between Boston and Washington, and apply it to the whole country, I do not mean to say it is a thing that could be done in a short time. It will probably take generations to accomplish it. But the necessity for it is quite apparent. When you bear in mind that the repairs on a steam locomotive cost more than the fuel used to run that locomotive; when you bear in mind that it is not possible to get highly efficient use of the energy contained in the fuel under the conditions under which a locomotive operates; when you recall that the steam transportation lines of the United States use somewhere between 175,000,000 and 200,000,000 tons of coal a year;

when you remember that the same work can be better done with less than one-third of the amount of fuel now used and with a better opportunity to exercise the power where it is needed: then you must see the reason for greater efficiency in our industrial operations.

All these things take vast sums of money. They cannot be secured by a policy of starvation. The steam railroads of the United States, under the policy pursued by the Interstate Commerce Commission, were starved to a point where the government had to take them over and become financially responsible for them to enable them to function during the great war. We cannot continue to pursue that policy and raise the money now necessary to enable those great arteries of commercial life to function properly. We cannot destroy values and practically rob a local utility of its property by refusing living rates for service and expect that utility to maintain its credit, and to function properly and properly develop the great improvements necessary to stimulate the increased commercial activity of a great community like the city of Chicago.

When I speak of robbing a public utility, I recall that in a great man parts o fthis country, so far as the local public utilities are concerned, the communities have performed exactly the same function in the last two years that you would perform if you put your hands into a man's pocket and took his money. They have forced those utilities—and with some of them it is being done right in this city today—to supply their service for less than actual cost of the necessary labor and material and interest on the investment.

We cannot do those things and get proper efficiency and industrial development. As I stated in my opening remarks, the effect of that kind of action is far greater on the whole community than it is on the particular owners of the properties that are being crucified. There is nothing that will stop community development so much as stopping proper transportation, either urban, interurban or interstate. There is nothing that will prevent the development of the business life of a community so much as the ill treatment of the great local utilities that it is necessary should function for the everyday requirements of a great community like this.

Therefore I say that you, who have particular opportunities,derived from your training as students and from your experience as practicing engineers, should take part in the discussion of the great public questions that come from time to time before the community. Instead of confining your efforts to the study of technical and scientific questions, you should consider your larger duty as citizens and become thoroughly familiar with the underlying fundamental principles governing all these great subjects. In giving the public the advantage of your mature judgment on such matters, you will not only be doing your duty as citizens, but you will be adding to the possibility of the development of the great republic of which we all are citizens.

May 20, 1920

ATTENTION!

Brewery in Middle West anxious to learn of some permanently profitable enterprise for which its plant can be economically converted.

Address XYZ, This Journal

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BRIDGE WORKS
85th Street and Stewart Avenue, Chicago

A Group of W. S. E. Members and Guests at Madison, Wis.

CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV JULY 20, 1920 Number 11

Safety Engineers Meet With W. S. E.

Safety engineers who attracted national attention through their effective work in the safeguarding of power presses adressed the conference of the Engineering Section of the National Safety Council which was held in the auditorium of the Western Society of Engineers on June 24. Safety as it affects production was the motive of the entire program of this conference, which was divided into three sessions, morning, afternoon and evening—the latter a dinner meeting.

The evening meeting was held jointly with the Chicago Safety Council, the Western Society and the Accident Prevention Committee of the Illinois Manufacturers' Association.

The entire afternoon session was devoted to a discussion of the safeguarding of power press operations and the information brought out during this discussion will be used in drafting the national safety code on power presses, sponsorship for which has been accepted by the National Safety Council. The complete program of the Chicago Conference of the Engineering Section follows:

Morning Session.

10 A. M.

1. Safeguarding machinery at the source — report of committee; H. A. Schultz, United States Steel Corporation, chairman.
2. A time study of cone pulley belt shifting—hand and mechanical, report of committee; H. E. Somes, Chevrolet Motor Co., chairman.
3. Report of Education Committee; Bruce W. Benedict, Manager of Shop Laboratory, University of Illinois, chairman.
4. Report of progress on safety codes:
    - (a) Codes for which Engineering Section N. S. C. is sponsor or joint sponsor.
        1. Power presses.
        2. Paper and pulp mills.
        3. Construction work.
        4. Blast furnaces.
    - (b) Codes in which Engineering Section N. S. C. is cooperating.
        1. Woodworking.
        2. Transmission.
        3. Others.

Afternoon Session

2 P. M.—Safeguarding power presses.

1. Automatic Feed for Power Presses, by F. J. Littell, F. J. Littell Machine Co.
2. How We Increase Production by Safeguarding Power Press Operation, by A. L. Kaems, Safety Engineer, Simmons Company, Kenosha, Wis.
3. Round Table Discussion. Fundamental Propositions Underlying a Safety Code on Power Presses (metal working).

Dinner, Hotel LaSalle, Chicago
Toast Master—H. G. Ellerd, Armour & Company

1. The Engineer and Production, W. G. Nichols, President, American Manganese Steel Co.
2. Safety and Production, Geo. A. Hart, Superintendent, Melrose Park Plant, National Malleable Castings Co.
3. Accident Prevention and the Engineer In Increasing Production, S. J. Williams, Secretary and Chief Engineer, N. S. C.

For address by Mr. Sidney J. Williams see June 20 issue. Subject: How Can We Increase Production?

Luncheon and Inspection

Through the courtesy of Mr. Julius Rosenwald, members and their guests are invited to a stag luncheon at, and an inspection of the plant of Sears Roebuck & Co. Friday, August 27th.

A post card notice will be sent each member by Mr. Cass Kennicott, Chairman, Excursion Committee.

The August 20th issue of the Journal W. S. E. will give complete information as to hour and place of meeting, how to get there, parking accommodations, etc. The date, August 27th.

National Public Works Department Association

Accomplishments and Prospects

Congress has adjourned without enacting legislation to establish a Department of Public Works. The fact in itself is neither discouraging nor unexpected. Many bills of equal importance and of earlier origin also failed, some of them having been vetoed by the President. Strong antagonism exists between the Executive and Legislative departments of our Government. Therefore, new legislation is difficult. We are able to draw important lessons relative to our public works measure made during the past legislative session. Each of us should take knowledge of the facts and determine whether he has done all that he reasonably could.

Excellent progress has been made in the campaign for a Department of Public Works. It is clear, however, that a large part of that progress has been made easy by the fact that our proposal is recognized as one of the most logical and praiseworthy that has been taken before Congress in many years. Were it not for this, our progress could have been measured by a hand's breadth. The really effective work has been done by a few persons in each state. To secure complete and prompt success at the next session of Congress it will be necessary that all persons who approve the principle shall participate in the effort.

Not by way of criticism but of friendly counsel, it may be helpful to illustrate the most important deficiency in our campaign. Some months ago the Chamber of Commerce, U. S. A., submitted a referendum to its constituent bodies on the public works matter. The work of the officers of the National Public

Works Association was necessarily confined to the giving of due notice and warning to the member organizations and campaign committees. Several such warnings were sent out and detailed suggestions were submitted for use in carrying the matter before the local chambers of commerce. The occasion furnished an opportunity for the technical men of the country to demonstrate their local interest and power. Hardly one of them could have failed to reach and favorably influence his local chamber had he chosen to do so. Nevertheless, the results of the referendum were that of 1250 member organizations located all over the country only 477 recorded votes. In response to Question No. 1 of the referendum, viz.: "Shall a Department of Public Works Be Established by the Federal Government?" the weighted vote was 826 in favor and 549 against. The referendum was, therefore, adverse because the number of votes necessary to carry was 917. We have knowledge that a number of important chambers of commerce voted adversely because the matter was not adequately explained by the local advocates of the movement. Nearly two-thirds of the member organizations of the national chamber failed to take action on the subject. The result is plainly due to lack of effort on the part of those who have given the principle their most enthusiastic approval.

Some of the members of the Senate and House of Representatives are at home and the remainder will arrive there soon; therefore, an opportunity still exists for the technical men of the country to make good. Go to see your Congressman and Senator at his home and tell him of your interest in the movement. The principles underlying it are easy to advocate. Even a cold presentation of the facts is convincing and there can be no possible excuse for the technical men of the country if, when the members of both Houses of Congress gather in Washington on the first Monday of next December, the great majority of them are not convinced of the necessity of aggressive action in the furtherance of the public works bill.

The Washington office of this organization has distributed facts, arguments and talking points very liberally, and is prepared to respond to all further requests. The officers of this organization cannot, however, force the literature upon the technical men nor by mandate secure their interested co-operation. The next six months will tell the story and the issue is squarely up to the advocates of a public works department. If, at the end of that period, the great body of citizens who are interested in Governmental efficiency shall have failed it is safe to say that this great and praiseworthy effort will also fail. The technical men of the country will have reason to be convinced that they are not yet ready for the full duties of citizenship and will be forced to regard the whole matter as another illustration of wasted opportunity. Therefore, don't fail. Get together with your friends and convince your members of Congress while they are at home.

M. O. Leighton,
Chairman.

Trustee

At the meeting of the Board of Direction, July 12th, 1920, Mr. G. A. Hart, Mgr. the National Malleable Castings Co., Melrose Park, Ill., was elected trustee to fill the vacancy made by the resignation of Mr. W. W. De Berard.

Terminal Committee Arranging for October Convention of American Association of Port Authorities.

At a recent meeting of W. S. E. the newly organized Terminal Committee made a tentative statement through its Chairman, Mr. J. Rowland Bibbins, on its contemplated activities, reported in another issue. The most important preliminary work falling to this Committee has been the preparation for the Fall Convention of the American Association of Port Authorities meeting here on October 4, 5 and 6. This Association is the strongest national body interested in the field of port development. It comprises in its membership roster men of experience and ability, not only in Administration, but in Engineering Design, including also some of the membership of the Society of Terminal Engineers.

It has been the effort of the Terminal Committee to secure close co-operation between the Port Authorities, Terminal Engineers and Western Society of Engineers with the specific object of having the problems of Chicago and the Great Lakes Ports discussed constructively before this convention. The tentative program of the convention to date includes addresses as per attached sheet.

The address by Col. John Millis was secured through the agency of the Terminal Committee and there will be two or three additional addresses announced later, with respect to the problems of the watergate of Chicago and its relation to water transportation on the Mississippi, the Great Lakes and overseas, dealing especially with the fundamental economics of the transport situation.

A glance at this program will suffice to indicate to the Engineers of the Middle West that it is high time Chicago's development received more thorough and intensive study.

Through the agency of the Terminals Committee, the Western Society of Engineers and the Society of Terminal Engineers have been officially invited to take part in this meeting of the Port Authorities, which will be the most important one ever held by this Association, especially as it occurs at a time when the investigations of the International Commission on the St. Lawrence Waterway are under way.

The last issue of the Association Bulletin mailed prior to the convention must be in the printer's hands by August 15. Hence it is important that those desiring to take part should advise W. S. E. promptly.

The Port Authorities' Association has met in many other cities, and it is the duty of the Chicago Engineers concerned in the broad development of the district to interest themselves in this forthcoming convention.

See page 26 for list of speakers.

Turning Munition Concerns In to Furniture Factories

Concerns which a short time ago were engaged on Government munition contracts in England exhibited modern office appliances and furniture of their own manufacture at the ten day Business Exhibition held last month in London. A notable example is a big company which has turned from the manufacture of airplanes to the production of a wide range of most excellent office furniture. This fine furniture manufacture, says the U. S. Consul at London, shows the post-war adaptability of the British manufacturer.

W. S. E. MEETINGS

EDGAR S. NETHERCUT - - - - - - **Secretary**

No. 1082

This was a general meeting of the Society, there being 39 members and guests present. C. F. W. Felt presided.

Mr. F. W. Thomas, supervisor of apprentices, Santa Fe R. R., presented an interesting paper, illustrated with lantern slides, on the "Santa Fe Apprentice System." Mr. Thomas is nationally known as an authority on this subject.

He said that in the last ten years the Santa Fe has not had to go outside of its own organization for men for its shops due to the establishment of the apprentice schools throughout the system.

The beginner is given practical instruction in the fundamentals of the trade which he desires to take up, then is placed in the shops under the supervision of an instructor. Four years are required to complete the course.

The railroad company provides wholesome recreation for the apprentices as well as its employees, he said. The aim of the entire apprentice system is to train the "hand, heart and mind," so as to make competent and contented employees. There was a long and interesting discussion of this subject.

The meeting was adjourned at 9:30 p. m.

No. 1083

On May 12th, the Electrical Section, W. S. E., held a joint meeting with the Chicago Section, A. I. E. E., in Fullerton Hall, Art Institute.

It was well attended, 225 being present, including many ladies.

Mr. James R. Bibbins, Supervising Engineer, The Arnold Co., Chicago, delivered an interesting talk on "City Building and Transportation." Mr. Bibbins showed how all city development was dependent on transportation. In Chicago, he said, there must be a greater development of the transportation systems to care for the increasing population which is now near the three million mark.

Investigations and surveys show, he said, that there must be a decentralization of business centers in order to eliminate the congested districts in the heart of the city. Now is the time, he declared, when engineers should interest themselves in such a question or else "acknowledge civic impotence."

Mr. Harold Almert opened the discussion of this paper by showing what could be done with the existing facilities in the city, to remedy the transportation system. He declared that during the hours of light traffic, these systems should be used to carry package freight and thus reduce the number of vehicles on the city streets during the day.

Dean J. F. Hayford stated that now is the time for the engineering profession to begin a campaign of education for the public. The benefits of technical thought will not be available to the public unless the profession makes use of the publicity facilities at hand, he said.

The meeting adjourned at 10:30 p. m.

No. 1084

Railway Engineering Section meeting on May 20th was presided over by Mr. H. G. Clarke, Vice Chairman. Over one hundred members and guests were present.

The Secretary announced the future meetings of the Society.

The Chairman announced that due to illness of Mr. W. H. Finley, President of the Chicago & Northwestern Railway, who was to address the meeting on the subject of "Some Railroad Problems," was not able to appear. Due to the late time of securing this information, it was not possible to substitute some other speaker. Inasmuch as railroad engineers are interested in the problems of terminals the Chairman explained that the Western Society had organized a terminal committee and requested Mr. J. R. Bibbins, Chairman of the committee, to explain the plan of his committee.

After Mr. Bibbins had explained the work of the committee, the same was discussed by Messrs. Reichman, Putnam, Noonan, Mohler and Nelson.

The Chairman then introduced Mr. E. T. Howson, editor Railway Age, who reviewed the difficulties which the railroads have encountered in undertaking private control at the termination of Federal control, such as the lack and impairment of equipment, depreciated maintenance resulting in the congestion of traffic. Mr. Howson also reviewed briefly the labor situation which is now being presented to the Railroad Labor Board.

The meeting adjourned at 8:45 p. m.

No. 1085

The first meeting of the new Telephone, Telegraph & Radio Section was held May 24th.

Mr. Fred L. Baer, Sales Engineer, Automatic Electric Co., delivered an interesting address on "The Transition from Manual to Automatic Switching of Telephone Traffic in Large Metropolitan Networks."

The report of the organization committee was presented and approved. The provisions of this report were:

Adoption of regular rules of the Society for Sections; that meeting should be held on the first Tuesday of each month with the exception of July, August and September; that the official name of the section be Telephone, Telegraph and Radio Section of the Western Society of Engineers.

The report of the Nominating Committee was presented. The nominees were:

Chairman, Frank F. Fowle; Vice Chairman, Stanley R. Edwards; Director, 3 years, Montford Morrison; Director, 2 years, Morris A. Frye; Director, 1 year, Fred L. Baer.

On motion duly made and seconded the Secretary was instructed to cast a unanimous ballot for the nominees, no other nominations having been made.

The paper of the evening was presented by Mr. Fred L. Baer, Sales Engineer, the Automatic Electric Co., who spoke on "The Transition from Manual to Automatic Switching of Telephone Traffic in Large Metropolitan Networks." Mr. Baer illustrated his paper with a number of lantern slides. There was an interesting discussion following the presentation of this paper.

The meeting was adjourned at 9:30 p. m.

No. 1086

One hundred members and guests were present at the general meeting of the Society on June 7th.

Mr. Linn White, 3d Vice President, presided.

Mr. Halbert P. Gillette, Editor, Engineering & Contracting, delivered an address on "Real and Imaginary Causes of High Prices."

Mr. Gillette developed in a very logical manner the controlling conditions which are commonly claimed as effecting the present high prices. By process of elimination he eliminated profiteering, extravagance and under production. He then developed the situation with regard to the money in circulation which, together with the lack of efficiency per capita, was stated as being the controlling features causing the present high prices.

The address was very instructive, and while the speaker held out no hope of an early return to a normal price level, he indicated that after a period of a few years there would be a slow but sure reduction in the cost of living.

The subject was discussed by H. P. Stephenson, Benjamin Brooks, Messrs. Lewis, Fitch, A. J. Schafmayer, A. Nechin, A. P. Allen, Pardee, Harold Almert, J. W. Lowell and E. S. Nethercut.

In closing Mr. Gillette states that the analysis he has made of the situation is one which is particularly an engineering analysis, and will be better understood by them than by the general public. The speaker also called attention to the importance of the engineer because of his efficiency and administrative ability to contribute largely to the elements which will control the cost of living.

No. 1087

At the general meeting of the Society held June 21st Mr. H. J. Burt, Past President, W. S. E., presided.

Mr. T. L. Condron, M. W. S. E., presented a paper on "State Registration of Engineers." Mr. Condron is chairman of the committee of Engineering Council which prepared a recommended bill for the registration of engineers, architects and land surveyors.

This meeting was attended by about 65 members and guests.

At the conclusion of the paper numerous questions were asked and a lively discussion was had with regard to the essential features of registration and the advisability of registration by law.

No. 1088

Mr. C. C. Boardman, Chairman, Gas Engineering Section, presided at the meeting held by that body on June 23d. Twenty-nine members and guests were present.

Mr. R. B. Harper, M. W. S. E., Chief Chemist, Peoples Gas, Light & Coke Co., presented a paper on "City Gas of the Future." This was illustrated by lantern slides.

Mr. Harper presented an engineering analysis of the trend of gas manufacture and sale, with reference to the supply and cost of materials entering into the present methods and indicated the necessity of judging the requirements of commercial gas in order to conserve the fuel of the country.

No. 1089

On June 25th, the Railway Engineering Section met. Mr. C. F. W. Felt, Chairman, presided. There were 18 members and guests present.

In the absence of Mr. Frank Nay, Vice-President and Comptroller, C., R. I. & P. Ry.; Mr. E. S. Morgan, Accountant, C., B. & Q. Ry., discussed "Railroad Rates and Valuation," calling attention to the necessity of a clear understanding and proper allocation of valuation of the elements entering into a complete valuation.

New Members

The following were elected to the grade of membership indicated, June 4:

25 Strock, Reeve O., 2148 Jackson Blvd. Student.
32 Stoecks, Roland, 1021 Lawrence Ave. Junior. (Transfer from Student.)
77 Reid, J. G., 29 S. LaSalle St. Member.
1167 Stuermer, Paul J., 916 N. Kedvale Ave. Member.
794 Edward W. Ryan. Associate.
1148 John B. Johnson. Member.
1086 Alpheus C. Dresser. Member.
1925 Oscar P. Laubscher. Member.
39 Ernest A. Earle. Member.
251 Michael Korosy. Member.
1311 Arthur V. Brown. Member.
2026 C. A. Benjamin. Associate.
43 Colson, Wilbur Gerald. Associate.
45 Benkler, M. W. Junior.
46 Stypzuski, T. P. Member. (Transfer from Associate.)
74 Haynes, David Oliphant, Jr. Associate.
75 Burroughs, E. E. Junior.
76 Sullivan, Joseph V. Associate.
78 Schwitkis, Julius. Associate.

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79 Jakoubek, Frank J. Junior.
80 Loebe, Frederick Arthur. Associate. (Transfer from Student.)
114 Fischer, Robert H. Associate.
488 Hess, Louis F. Associate.
719 Sanborn, R. A. Member.
884 Henschel, Ottomar H. Member.
901 Booth, G. E. Associate.
1070 Williams, D. D. Member.
1075 Hughes, T. W. Member.
1097 Butterfield, F. E. Associate.
1136 Anderson, Geo. A. Junior.
1233 Baker, F. G. Junior.
1239 Carr, Bradley Sayre. Associate.
1422 Guth, Fred Otto. Member.
1466 Carlson, Fred L. Junior.
1494 Gremley, B. G. Associate.
1587 Donald, James. Member.
1645 Bell, E. H. Affiliated.
1654 Fried, Albert O. Junior.
1712 Etzbach, W. W. Member.
1785 Vangel, C. B. Associate.
1823 Sanders, A. D., Jr. Member.
1831 Inman, S. D. Associate.
1836 Kaiser, C. A. Junior.
1837 Ehrkr, F. R. Member.
1840 Schott, W. H. Member.
1844 Harkness, Wm. Edward. Member.
1856 Mercer, James H. Affiliated.
1858 Eggert, Edwin O. Member.
1862 Coesfeld, Henry M. Junior.
1947 Narowetz, Louis L., Jr. Associate.
1953 Whiting, Fred T. Member.
1960 Taylor, Andrew M. Junior.
1961 Spencer, John P. Affiliated.
1979 Bersie, Hugh G. Junior.
1985 Chapin, A. L. Member.
2021 Dobbs, Paul A. Junior.

Federated American Engineering Societies

Pursuant to a call issued by the Joint Conference Committee of the Four Founder Societies a conference was held in Washington on June 3rd and 4th at which was present one hundred and twenty-three delegates from sixty-one engineering societies.

The call contained the following statement of purpose: "Co-operation of engineering and allied technical organizations to further the technical knowledge of public welfare wherever technical knowledge and engineering training are involved and to consider matters of common concern to these professions."

About two years ago the American Society of Civil Engineers created a committee on development, the object of which was to study the affairs of the Society, the relation of the same to the affairs of other professional bodies, and also the relation to the public. Shortly afterwards similar committees were appointed by the American Society of Mechanical Engineers, American Institute of Electrical Engineers, American Institute of Mining and Metallurgical Engineers. Inasmuch as the problem before each of these committees had many things in common it was deemed advisable to appoint a joint conference committee with representation for each society from their development committees.

The Joint Conference Committee presented reports to each society which was considered as part of the development committee's report. After due consideration the Managing Boards of the American Society of Mechanical Engineers, American Institute of Electrical Engineers, and the American Institute of Mining and Metallurgical Engineers in effect endorsed the Joint Conference Committee's report recommended that a conference be called to consider the plans of organization proposed by the Joint Conference Committee.

The American Society of Civil Engineers at its annual meeting in January of this year, after discussing the report of the Development Committee including the report and recommendations of the Joint Conference Committee, submitted to the membership for letter ballot a series of questions. As a result the majority favored broadening the activities of the Society, but a small majority voted against actively co-operating in the creation of the comprehensive organization proposed. While there was considerable discussion of this report at the annual meeting, and while the technical press editorially advocated the formation of a new organization there were less than one-half of the members of the Society who registered an opinion either for or against this important question.

The conference called at Washington was quite unanimous in its action. The first action was the consideration and adoption of the following resolution:

"*Resolved* that it is the sense of this convention that an organization be created to further the public welfare wherever technical knowledge and engineering experience are involved, and to consider and act upon matters of common concern to the engineering and allied professions.

"*Resolved* that it is the sense of this convention that the proposed organization should be an organization of societies or affiliations, and not individuals."

With almost equal unanimity a constitution was adopted which, for the information of our membership, is published in another column.

It is now proposed that the form of organization be considered by the constituent societies for approval and confirmation, and therefore it is of considerable interest to our Society that its membership should be fully advised.

While not the object of this article to discuss the merits or advantages of this organization, it is hoped that our members will avail themselves of the columns of our Journal to discuss this matter fully. At a later date the Board of Direction will undertake to ascertain from the members their sentiments with regard to our organization becoming part of the Federated American Engineering Societies.

Some editors urge that this be done promptly. There seems to be a fear that delay may wreck the federation plan. We believe, however, that the engineering profession will want time to consider this matter in detail, and there might be danger also of undue haste in a final consideration. It is hoped, however, that individual members will take such steps as to inform themselves fully and act in the best interests of the profession as a whole.

There can be no question but that the profession will favor action which will promote the active participation of engineers in matters affecting the public welfare, and if incidentally this will place the engineer before the public in a favorable light, thereby increasing his prestige that is secondary to the main purpose.

Consideration should be given to determine whether activities promoting the public welfare are essentially local, or whether local activities will be proportionally benefited by a national organization of this kind—whether the expenditure of time and money proposed is proportionate to the benefits to be derived. A certain amount of organization is reasonable and to be expected. There may be some danger in setting up a plan which has the best of intent, but which in itself is cumbersome and may prove because of this ineffectual. Many other considerations should be given to this important subject by our interested members.

Engineering Council during the past few years has been caring for the work now proposed as the purpose of the new organization. Pending the decision of the various Engineering Societies.

Obituary

Louis J. Putnam, chief engineer, Chicago & Northwestern Ry., was drowned near Le Roy, Mich., May 31, while attempting to rescue his son. He was born at Manchester, Iowa, in 1878, and was educated at Cornell College, Mt. Vernon, Iowa. He began railroad work in June, 1898, with the Illinois Central, and a year later entered the engineering department of the Chicago & Northwestern as an instrument man. In February, 1901, he was appointed assistant engineer and thereafter was engaged on construction, location and maintenance work. He was later made acting division engineer of the Ashland division, with headquarters at Kaukauna, Wis. In March, 1907, he was assistant engineer in charge of second track and terminal improvements at Janesville, Wis., and later assistant engineer in charge of the construction of the bascule bridge over the north branch of the Chicago River and the Wells Street yard at Chicago; resident engineer, Milwaukee track elevation, and resident engineer, Escanaba Ore Dock construction. From July, 1910, to April, 1912, he was in the service of the Milwaukee, Sparta & Northwestern, a subsidiary of the Chicago & Northwestern Ry., first as resident engineer on construction and then as acting resident engineer.. In April, 1912, he was promoted to division engineer at Boone, Iowa, and in May, 1913, he became principal assistant engineer of the Northwestern, with headquarters at Chicago. In June, 1918, he was appointed chief engineer of the Northwestern.

Will Be Slow Price Decline—Gillette

The amount of money in circulation, combined with a lack of efficiency per capita, is the cause of present high prices, declared Halbert P. Gillette, editor of *Engineering and Contracting,* before a general meeting of the Society, June 7.

Mr. Gillette's subject was "Real and Imaginary Causes of High Prices." One hundred members and guests were present, Linn White, third vice-president, presiding.

The speaker logically eliminated profiteering, extravagance, and under-production which are most commonly claimed to effect high prices today. He held out no hope for an immediate return to normal price levels, but indicated that after a period of a few years there would be a slow reduction in the cost of living.

H. P. Stephenson, Benjamin Brooks, C. B. Lewis, C. E. Fitch, A. J. Schafmayer, A. Nechin, A. P. Allen, H. S. Pardee, Harold Almert and E. S. Nethercut discussed the subject.

Closing, Mr. Gillette said his analysis was particularly one for engineers and will be better understood by them than by the general public. He emphasized the opportunity the engineer has to contribute largely to the elements which control the cost of living.

Special reference to the formula developed by the speaker in connection with this subject was made in the March 20 Journal.

To Counteract Shorter Hours

The installation of the most modern machinery, no matter how costly, is a justified and paying investment if it results in increased production with reduced man-power, shorter hours of labor, less efficiency of labor.

In fact, any method of cutting production costs and increasing plant output is receiving serious consideration nowadays by captains of industry—even the little things that they were wont to dismiss with a contemptuous wave of the hand a few years ago.

For instance, factory lighting wasn't considered a matter of much importance less than a decade ago. It wasn't realized and it didn't matter much anyhow if operatives did lose some time stopping to rest tired, strained eyes, wearied by poor light on their work. They were mostly low paid people, working long hours, and even under bad lighting conditions production costs were low.

But now there is hardly any such thing as cheap help; hardly anybody works long hours and few exert themselves to produce a full day's output. Every possible idea of science and ingenuity must be taken advantage of to counterbalance the modern attitude of labor.

New factory buildings are mostly windows; old buildings are generally too dark. But it has been found that they can be lightened up a great deal by painting the interior wood, brick, cement or plastered walls with a snow white, washable oil paint having a maximum of light reflecting properties.

And it is remarkable the influence a seemingly little thing like this has upon production. Eye strain causes headache. No operative will even try to produce to capacity when not in good physical condition. But his high wages go on just the same. Better lighting removes the cause. Increased output, more accurate work, less breakage and spoiling of materials pays for the painting many times over.

Electric Power Production and Fuel Consumption

Interesting statistics concerning the production of electric power and consumption of fuel by public utility power plants in the United States for the first three months of this year have just been issued by the U. S. Geological Survey. The records for Illinois are especially noteworthy as they show to what extent public utilities of this state depend on coal for fuel and this brings out the point that our systems of transportation must be kept intact in order to preserve the efficient operation of our electric power plants.

The statistics show that:

Total K. W. H. produced in U. S. by water power and fuels was 11,114,845,000.

Total K. W. H. produced by water power was 3,857,275,000.

7,257,570,000 K. W. H. produced by fuels.

Of this total Illinois produced 43,566,000 K. W. H. by water power and 747,129,000 K. W. H. by fuels or a total of 790,695,000 K. W. H.

To produce this total in the United States required 10,247,947 tons of coal, 3,481,742 barrels of petroleum and derivatives and 4,553,228 cubic feet of natural gas.

Utilities of Illinois consumed 1,192,499 tons of coal, or more than one tenth of the total amount used; 1,302 barrels of oil and no natural gas, producing electric power.

These figures speak for themselves in showing the need for developing water-power resources, especially in this state.

The YOUNG MEN'S FORUM

BENJAMIN SHAPIRO, Chairman

The original charter of the Institute of Civil Engineering (London), granted by the British crown in 1828, defined engineering as the "art of directing the great sources of power and nature for the use and convenience of man as the means of production and of traffic, etc." In the passage of the century since the formulation of that definition, great schools have grown up in all the nations for the furtherance of knowledge in that art, and today many thousands of men, graduates and students of these schools, are fitted, and are being fitted, to carry on the progress of that art. By force of circumstances these schools are purely institutions of learning. Great numbers of men with a common ideal—the attainment of engineering knowledge—are brought together under the tutelage of instructors with a like ideal, and necessarily with the attainment of that knowledge, become, by the very intensity of their study, circumscribed in their living and their thinking.

Modern life has become so highly developed that there is practically no small act of any individual that is not dependent on or resultant from the practice of engineering. Every business, every development is related to some sort of engineering. The entire fabric of civilization touches upon engineering at every juncture.

It therefore is needful that the engineer, in addition to proficiency in his chosen art should be in the proper social relation to the rest of the world; that he should understand the relation of the great branches of business, of commerce, science, to his own branch, in a practical way, and that he should appreciate his responsibility towards society and should know the best means of discharging that responsibility. In other words, engineering training largely transmutes a man into a thinking machine. The need is to humanize that machine to enable that machine to function freely, not only as a machine but as a unit in the great structure of society.

The Young Men's Forum of The Western Society of Engineers is, in a small way, attempting to fill this need. Organized over two years ago, the first objective was the discussion, at a round table, of the affairs of the Society, from the point of view of the younger members. It was felt that social progress had given rise to various problems peculiar to the younger men of the Society, and that an intimate discussion thereof, with the idea of formulating definite conclusions for submission to the Society as a whole, would be beneficial to all. Successful from the start, the subjects discussed at these meetings gradually increased in range until they have entirely outgrown their original scope, and have a particularly instructive and broadening trend in a personal way.

On the second and fourth Thursday evenings of each month, in the Society rooms, a group of from 20 to 50 men gathers. They are all young—either in years or in spirit. The subject for the evening is always intended to solve some of the personal problems of the participants, entirely informally, the Chairman procures from each member present, if he is there for the first time a brief outline of his biography, which includes his schooling, training and his present work. He then acquaints the new members with a brief biography of each of the other members who had been present at previous meetings. The person scheduled to present the question for discussion is presented by the Chairman in the same way. He is given to understand that the young men present feel at liberty at any time to interrupt him and present questions or start discussions, but that there is no malice behind these interruptions as the young men are all there for their mutual improvement and development. Each member is encouraged to present his views and procure discussion thereof.

An attempt is made to bring in men outside of the engineering profession to talk on subjects not directly relevant to engineering, such as efficiency of various kinds as applied to the human rather than to the material side, economics, construction problems, in fact anything that will give those present a knowledge of what is going on in the other walks of life. With this in view, meetings have been held of late with the following as topics: Engineering Efficiency, with Mr. H. P. Gould, Editor of The Efficiency Magazine leading; The Engineer in Editorial and Sales Field, with Mr. E. T. Howson, Editor of Railway Age leading; The Interrelation of Engineer, Contractor and Architect, with Mr. F. M. Carroll, General Superintendent, Holabird & Roche leading; Public Speaking as Applied to the Engineer, with Mr. Benj. Bills of the Continental and Commercial National Bank, Trust Department, leading; etc.

Another aim is to encourage in the younger men participation in affairs by breaking down their reserve, widening their acquaintanceship among fellow engineers and above all, broadening them in the various lines of work.

These meetings are open to all. The only qualification necessary to become a member of this forum is your presence at these meetings.

Starting in the fall, an attempt will be made to hold a series of Saturday afternoon "get-togethers," the number depending upon the response that will come when the call has been issued. These "get-togethers" will have two objects. First, full and free intercourse with a view to widening the personal acquaintanceship of all those present; second, the indirected discussion of those subjects which are uppermost in the minds of the participants.

An attractive program is being outlined for the winter, but, as usual, to make all of these meetings successful, the active co-operation and assistance of every member of the Society must be given. The Chairman of this Young Men's Forum is Chairman only in name. Each and every member must feel it his duty to aid the Executive Committee of this Forum in presenting their programs. Announcement will be made of the first meeting in the regular way. Meanwhile any suggestions will be welcomed by the Chairman.

List of Tentative Speakers at Convention of the American Association of Port Authorities, to Be Held in Chicago in October

(*Continued from page* 16.)

SIR JOHN KENNEDY, Consulting Engineer, Montreal.

JOHN MEIGS, President Society Terminal Engineers, on "The Port of Wilmington, Del."

LT. COL. G. H. KIRKPATRICK, Chairman of the Harbor Commission, Vancouver, B. C., on "The Port of Vancouver and Its Proposed Development."

CHARLES B. MOORES, Chairman of the Commission of Public Docks, Portland, Ore., on "Portland's Past, Present and Prospective Relation to the Commerce of the Pacific."

CARROL W. SIMON, Philadelphia, on "Dry Goods and Ship Repair Plants as Necessary Auxiliaries of Well-Balanced Ports."

F. W. COWIE, M. Inst. C. E., Chief Engineer, Harbor Commission, Montreal.

HON. CALVIN TOMKINS, New York, on "Standardized Unit Containers to Facilitate Terminal Handling and Distribution."

E. L. COUSINS, C. E., Chief Engineer, Harbor Commission, Toronto, Ont., Canada.

JOHN H. McCALLUM, President Board of State Harbor Commissioners, San Francisco, Cal., on "The Harbor—San Francisco's Greatest Asset."

DR. R. S. MacELWEE, Director of the Bureau of Foreign and Domestic Commerce, Washington, on "The Quay and Warehouse vs. the Pier System."

GEORGE F. SPROULE, Director Department of Wharves, Docks and Ferries, Philadelphia, Pa.

J. SPENCER SMITH, President New Jersey Board of Commerce and Navigation.

W. O. HUDSON, President Board of Commissioners of the Port of New Orleans.

THOMAS C. SORBY, Secretary Inner Harbor Association of Victoria, Victoria, B. C.

WILLIAM T. DONNELLY, Consulting Engineer, New York, on "Harbor and Terminal Facilities and Relative Despatch of Land and Water Transportation."

A. R. SMITH, New York, on "The Port of New York—the Greatest Port in the World."

COL. JOHN MILLIS, Corps of Engineers, Central Department, U. S. A., it is expected, will deliver an address on "Nature's Preparations for Deep Water Harbors on the Great Lakes."

Wood Construction in Shamrock

New York, July — "The wonderful strength of carefully selected, well-seasoned and properly disposed wood" is emphasized by the designers of Sir Thomas Lipton's challenging yacht, "Shamrock IV" as quoted in an article in a recent "Scientific American" which gives the leading characteristics of this craft.

Although "Shamrock IV" is of practically the same displacement as the cup defender, "Resolute," it carries 25 per cent more canvas or 10,800 square feet as against 8,650 square feet for "Resolute." "Shamrock IV" is a boat of great initial stability, capable of carrying a huge spread of canvas—its spread of sail reaching 170 feet above the deck—and this ability is due, according to its designer, to the "wonderful strength" of the wood. The hull is sheathed with three layers of mahogany, two layers inch thick, placed diagonally in opposite directions at 40 degrees to the vertical, and an outer layer ⅝ of an inch thick, placed longitudinally, the whole being very thoroughly fastened together with the joints evenly distributed. The deck is of birch veneer, ⅝ of an inch thick and the hull is stiffened against distortion by running birch veneer bulkheads at each web frame from the bilge to the deck along each side of the hull. The hull is also stiffened longitudinally by a series of wood longitudinals, about 2½ inches square in section.

The mast, 2 feet in diameter, is of wood and hollow, as are the other spars. The topmast truck is 145 feet and the top of the clubtopsail 170 feet above the deck. This means that if Shamrock were afloat on Broadway the topmost point of her clubtopsail would be level with the cornice of a 14-story building, and this, on a waterline of 75 feet.

Co-operation With Engineering Station Recommended

The special committee authorized by the Board of Direction to meet with Prof. W. M. Wilson of the University of Illinois, for the purpose of discussing the suggested co-operation between the Western Society and the Engineering Experiment Station of the University, has reported on a line of action whereby the suggested co-operation might be put into effect.

The committee believes that many associations representing industrial groups would be interested in research work applied to problems of importance to their particlar industries, and that they would be ready to pay the expenses involved in such investigations if the matter were fully and properly placed before them.

Under this plan of co-operation the Western Society would act in the capacity of a clearing house. It would not be called upon to contribute funds aside from the additional office expenses that would necessarily be involved. Its function would consist in bringing to the attention of industries the fact that the University is equipped to solve their problems for them, and that the Western Society is co-operating with the University and is anxious to assist the industries in making arrangements for the investigations. Thus industry would be taught to look to the Western Society as the agency through which their industrial problems might be placed into proper hands for solution.

In order to get this plan under way, the committee has recommended that the Society take the following steps, provided that an agreement is actually made between the Society and the University:

(1) Appoint a large general committee of Western Society members, representing all branches of engineering and including several men connected with the University.

(2) Arrange to have a representative of the University meet the general committee and instruct them as to what is to be accomplished.

(3) The general committee should then carry out a campaign of advertising among industrial associations and individual organizations,

advising them of the agreement between the Western Society and the University, telling them that the University is equipped to solve their industrial problems.

(4) The third step being well advanced, the general committee would then urge the industries to submit lists of unsolved problems in need of solution.

(5) The final step would consist in inducing industrial associations and individual organizations to appropriate funds for carrying out the investigations.

Recent Visitors at the W. S. E., New York

Col. H. S. Crocker, A. S. C. E., New York, enroute home from Denver, Colo.

Mr. Frank L. Anders, M. W. S. E., Consulting Engineer, Fargo, N. D., was a recent caller at the W. S. E.

Mr. L. K. Armstrong, Mining and Consulting Engineer of Spokane. Wash., called on his way across the continent.

Mr. Armstrong is president of the Spokane Engineer Society and said that his organization is very much interested in the W. S. E.

He very cordially invited any M. W. S. E. who has occasion to be in Spokane to call upon him. His address is 720 Peyton Bldg., Spokane.

The Freeman-Riff Company is just completing its new plant at Terre Haute, Indiana. This company manufactures conveying machinery, specializing in the design, manufacture, and installation of complete conveyor installations, particularly for the handling of coal in boiler plants and retail coal pockets. It also handles light structural steel fabrication. The new plant is of modern construction and is being fully equipped to handle this type of work.

Mr. J. B. Freeman, M. W. S. E., the president of the company, will be in direct charge of plant operation and production. He is a mechanical engineer by training and has been actively identified with the conveying machinery field for the past thirteen years. Before joining the Freeman-Riff Company, he was chief engineer of the De Pere Mfg. Co., of De Pere, Wis., and prior to that chief engineer of the Webster Engineering Co., of Chicago, Ill.

Mr. D. M. Riff, the secretary-treasurer, is also a graduate engineer who has been connected with conveying machinery work for the last six years —first as designing engineer and later as sales engineer. He recently resigned from the American Steam Conveyor Corp., with whom he had been connected during the past three years as assistant manager of the eastern office at New York, in order to take active charge of the sales and finances of this company.

The consolidated Index and Contents for Volume XXIV, 1919, of the *Journal* are now on the press.

These are complete — from January to November, inclusive. There will not be a December, 1919, number issued.

Any one desiring a copy of the Index and Contents may have same by applying to Editor.

EMPLOYMENT SERVICE

NO CHARGE is made for opportunities announced in this section of the Journal.

ANNOUNCEMENTS must not be more than sixty-five words in length and will not be inserted more than twice during a period of two months, during which time all records will remain in the active files. All correspondence will be treated confidentially.

APPLICANTS for situations, not members of the W. S. E., must have card of introduction from a member of the Society.

ALL REPLIES should be addressed to the key number indicated, in care of Employment Bureau, Western Society of Engineers, 1735 Monadnock Block, Chicago.

Positions Available

A-70: WANTED — STRUCTURAL designer with mech. experience; familiar with coal and ore handling machinery; salary $250 per month.

A-71: GRADUATES WHO DESIRE to connect with a large manufacturer of miscellaneous electrical household appliances; located in Chicago, Ill. We need four men from 1919 or 1920 graduate class who are ready to spend one or two years learning the details of engineering, sales, production or manufacturing department.

A-72: WANTED — MECH. ENGINEER to take entire charge of mech. department of large industrial engineering firm in Chicago; thorough knowledge of power plant, heating, plumbing, ship equipment, etc.; salary, $5,000 to $10,000.

A-73: WANTED — ENGINEER with experience on the design of machinery and plant layouts, to take charge of the Engr. department of medium sized manufacturing plant near Chicago; location ideal.

A-74: WANTED—MEN ABLE to handle inspection work on building construction and also to be available for building and mechanical drafting.

A-75: INSTRUCTORS IN VArious departments of well known state university; vacancies in architectural, civil engr., electrical engr., mech. engr., theoretical and applied mechanics, physics and railway mech. engr. departments; salaries, $1600 to $1800 for 10 months, depending upon qualifications of candidate.

Positions Wanted

B-700: MECH. ENGINEER specializing in machinery design, factory maintenance, extension, investigations and reports; available for such work on part time basis.

B-701: GRADUATE MECH. ENGINEER, best references, open for power plant, testing and electrical engineering; technical writing or sales engr. work.

B-702: A-1 STRUCTURAL ENGINEER and designer open for position in Philippine Islands or other foreign work; married; will consider two-year contract with expense for moving.

B-703: CORNELL GRADUATE, C. E. 1919, with experience in surveying and construction, wants position, preferably with railroad terminal construction project.

B-704: ENGINEER NOW EMployed; having experience: railway location and foundation work, Ry. construction, fixed and movable bridge design and construction; major with Canadian railway troops overseas; open for position where he can make use of his experience as executive and handling men; salary, $5,000; best references.

B-705: FIRST CLASS DRAFTSman desires work on construction details for private parties.

B-706: GRADUATE MECH. ENgineering Univ. of Wisconsin, with especial qualifications along steam and gas engineering lines available for position in such work.

B-707: DESIGNER ON CONcrete and industrial buildings and estimator who can take care of office work and who is familiar with sub-contracts in above work, desires outside work; eight years experience; best references.

B-708: ENGINEER, AGE 45; married; with good technical education, having broad general experience; thoroughly familiar with construction work, surveying, drafting room practice, machine design and shop practice, including actual operation of various machine tools; has done research work on clay products and smelter practice; will consider position as chief engr. or supt. of construction on construction work or manufacturing plant; salary, $5,000; best references.

B-709: GRADUATE C. E., Northwestern University; has had experience in general construction work, road construction and was asst. engr. of large city; desires position as supt. of construction; designer, structural steel or reinforced concrete, or as estimator.

Board of Direction

A special meeting of the Board of Direction was held June 4 at which time a number of new members were elected and new applications for membership in the Society received. The list of these will be found in another section of this Journal.

The Board instructed the Secretary to write the President of the United States urging the appointment of an engineer of national repute as a member of the International Joint Commission, at the request of the Inland Waterways Committee. The name of the committee was changed to that of the Waterways Committee.

A report of the Public Affairs Committee, declaring that the plan to abolish all but one local election is not a constitutional matter, but one requiring legislative action, was approved. The committee further recommended that the city ordinance providing for a fifty ward plan and a redistricting of the city be presented to the voters for a referendum at the fall election. This recommendation was approved.

The Western Society will apply for membership in the Air Board of Chicago, the directors decided after receipt of a communication from Bion J. Arnold.

The secretary was instructed to write to the Interstate Commerce Commission, at the request of the National Federation of Construction Industries, urging the importance of supplying proper transportation for building materials.

The report of the organization meeting of the Telephone, Telegraph and Radio Engineering Section was received and approved.

The resignation of George L. Johnson was accepted.

The Society of American Military Engineers

Recognizing the necessity, should any future emergency arise, of having our technical service properly mobilized, there was organized last winter the Society of American Military Engineers.

This Society met with immediate favor with the Engineer officers who served during the World's War and in response to the natural demand it was decided by the headquarters at Washington to organize sections in the large business centers throughout the United States. The Society is in direct contact with the office of the Chief of Engineers and receives from that office the closest co-operation. In this way the efforts towards systematic and thorough preparation and mobilization of the technical services are greatly expedited.

The Chicago Section has been organized with the following officers: President, Lieutenant Colonel C. Van Deventer; First Vice President, Colonel William Arn, Second Vice President, Captain William Ward; Secretary, Captain J. T. Montgomery. The directors are: General William H. Bixby, formerly Chief of Engineers; Colonel William V. Judson, Lieutenant Colonel Edward J. Blair, Colonel Horace S. Baker, Major Walter A. Hill, Major J. de N. Macomb, Colonel Henry A. Allen. Among others closely associated with the organization are: Captain C. M. MacChesney, Major Edwin W. Allen, Lieutenant Colonel O. P. Chamberlain, Captain George B. McClary, Major John C. H. Lee, Major R. I. Randolph.

The Society is not exclusively intended for those who have served in the Corps of Engineers or any engineering activities during the war, the membership being divided into two classes, active and associate members.

The active members which comprise all persons holding commissions as officers in the Engineer Service of the Military Forces of the United States or who having held such commissions have been honorably separated from such engineers' service, also all persons qualified as technical engineers, serving in any capacity in any arm, department, or service of the Military Forces of the United States or who having so served have been honorably separated from the Military Service. No person in a non-military capacity shall be eligible to active membership until he shall have completed six months continuous service as a technical engineer in an arm, department or service of the regular army of the United States.

The Associate members comprise all persons not included in the preceding paragraph holding commissions as officers of the Military Forces of the United States or in the United States Navy, including the Marine Corps or the Coast Guard, or having held such commissions, have been honorably separated from service of the United States. Also all persons duly enrolled as members of Technical Engineering Units of the Reserve Officers' Training Corps; also all civilians of suitable technical qualifications interested in the Military Engineering Forces: also all persons serving in any military capacity and Technical Engineering Units of the Military Forces of the United States or who having so served have been honorably separated from military service.

It is the earnest endeavor of the Society to secure the co-operation of the technical societies towards making the engineering establishment as closely coordinated as possible in the necessities of preparedness. The army activities are so broad in the engineering field, that there is opportunity for wide expansion in the form of committees to fulfill their requirements.

In the last war, the technical troops covered nearly every branch of engineering, including standard gauge, and what was known as light railways, shop supply, water supply, mining, quarry, general construction, electrical and mechanical, camouflage, searchlight and many others. There is no place in the country that holds out more advantages for engineer preparedness than Chicago and it is the earnest desire, some time in the future, that an armory can be located in that city that will house the engineer services with equipment necessary for proper training of the engineer troops.

The official magazine of the Society is "The Military Engineer." It is issued every two months and contains not only interesting, but very valuable articles from engineers on subjects dealing with the developments taking place in the field covered by the Society.

The great war is over and from its lessons must be built the foundation of efficient service, both in equipment and personnel.

TECHNICAL SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV JULY 20, 1920 Number 11

The Packingtown Waste Problem

By Langdon Pearse, M. W. S. E.,
Sanitary Engineer, Sanitary District of Chicago.

Presented September 22, 1919.

In view of the present activity and urgency of action on the packing-house waste situation in the Sanitary District of Chicago, this paper has been prepared to summarize the situation, by an outline, from its inception, so that some idea may be gained of what the problem is and what the Sanitary District and the packers are trying to do.

The problem started many years ago, in 1865, when the "Yards" were first located just south of Thirty-ninth Street. The kill in that year was a little over one hundred thousand. It has grown so that it is now around twelve million head of animals slaughtered, comprising cattle, calves, hogs and sheep, with a total weight of about four billion pounds per year. It is because somewhat less than one per cent of that weight gets away, that our problem has arisen. Of course, in the beginning, the loss was greater, for in the early days the packers threw away everything except the meat, but they were gradually led to make recoveries of by-products so as to keep the cost of meat down. They have continued along that line and now practically everything is saved except this small residuum, less than one per cent, according to the comparative figures we get from our survey. This is enough to make much trouble for us, because that one per cent amounts to between fifty and seventy-five tons of dry solids a day, going down the Main Channel, and is equivalent in the liquid form to the pollution from a population of about one million people. The exact figure depends upon the amount of killing going on in the "Yards" at any given time. This varies between winter and summer. More killing is done in the winter than in the summer.

This load has an important bearing on the sewage disposal of Chicago, because, under the present conditions, our flow is likely to be limited by the United States Government. There is still a suit before Judge Landis in the Federal Courts to determine the amount of water which the District should have, but the Judge has not indicated any date for announcing his decision. At the same time there is a very definite movement on foot to try and settle the case out of court by making an agreement with the Government for a certain definite diversion from Lake Michigan, coupled with an adjustment of the lake levels by building controlling works at the outlets of Lakes Michigan, Erie and Ontario. This will satisfy not only the lake level critics, but also the Canadians, who believe that they do not receive enough water, or at least not at the time when needed in the St. Lawrence River. It simmers down to a problem of giving each party what it wants, when it wants it. There is enough water in the lakes during the whole year for everybody if each could have it at the right times. We want our flow the entire year around; the Canadians on the St. Lawrence want theirs mostly in the early fall so as to keep up the level in the St. Lawrence for shipping, particularly at Montreal.

The important point in Chicago from the sanitary standpoint is that the particular load from this packing-house district—equivalent to approximately seven hundred and fifty thousand to a million people—is a very big percentage of our total load. We have a population today of about two million eight hundred thousand draining into the channel. It is fair to say that with this packing-house load and other industrial loads, the equivalent load on our channel may, at times, be as high as three and a half or four million people. It varies; for instance, during a strike in the Stock Yards the load dropped off. It varies too with the industries in other parts of town—other kinds of industries.

Aside from the strictly industrial problems, it is evidently necessary in carrying out such a scheme as the Sanitary District, involving the disposal of sewage, that some steps be taken to remove the suspended matter, and further to purify the liquid. We have reached that point and simply have to face it. It is not possible to get the water from the Lake. It is not possible to continue discharging the suspended matter down the stream. It does not take our reports to show that. It can be verified from the State reports on the condition of the Illinois River, which show the pollution traveling down stream each year. Now is the time when the District and the United States Government, and the public of Chicago, must work together to keep the situation under control and work it out logically. That is the reason why for a number of years we have been studying this problem in much detail.

We have been holding conferences with the packers, endeavoring to adjust amicably the differences between us in order to formulate a working program. The differences, it may be judged, amount to something, because the estimates that are mentioned later amount to about four million dollars, more or less. Four million dollars in 1917 means more than that today. The Sanitary

District offered originally to pay fifteen per cent of that four million dollars as an equivalent of the sixty thousand people who work in the "Yards." The packers thought the District should pay sixty per cent. The balance has been swinging to and fro. The packers have finally agreed, tentatively, to pay sixty per cent if the Sanitary District will pay forty.

Some of the civic organizations have also become interested in the negotiations. While they think that properly the public might pay more than fifteen per cent, they have finally agreed to the upper limit, as they believe that to effect a compromise it is desirable that the public pay as much as is equitable. There is no precedent for such a decision, no established rule by which that equity can be worked out along exact or mathematical lines. Compromise must be resorted to. Such is the situation today from the standpoint of the general problem and the relation of the packers and the Sanitary District.

The history of the present action dates back to 1911, when we began work actively in the "Yards." We studied the behavior of each house, measured the flow, and found that a great deal of material was escaping. Even though it was not of very much value to the packer, it was troublesome to us. Then we put up a testing station with the co-operation of the packers, who paid about $2,500 toward the cost. We ran that for two years, and found out what could be done in handling the sewage from this community, a mixture of both domestic and industrial sewage. It is strong, compared to other cities, and very strong compared to most of the domestic sewage in Chicago. The volume varies from day to day and from hour to hour, and drops off very much on Sundays. We measured the flow at the outlets of all the sewers and obtained the amount and its strength. The strength, which varies, is about eight times as strong as the sewage at Thirty-ninth Street—our large pumping station. The average sewage contains five or six hundred parts per million of suspended matter, and two to four thousand pounds to the million gallons of dry solids, depending upon the condition and time of the year.

The testing plant built by the District contained a grit chamber to study the removal of fat and grit. There was not much grit, but that chamber within a period of about thirty seconds removed from five to one thousand pounds of fatty scum per million gallons, depending on the weather and temperature. We recovered much more in cold weather than we did in warm weather, because the sewage was colder and apparently below the melting point of the grease. In the plant were double-deck tanks of the Imhoff type, which removed sixty to seventy per cent of the suspended matter. Chemical precipitation was also tried, using iron and lime. The amount of sludge varied from three to six, sometimes as high as eight, cubic yards per million gallons. None of the processes, however, for removing the suspended solids alone, seemed sufficient, so the settled liquor was applied to a filter at a rate of about three-fourths of a million gallons per acre on a bed, six feet deep. That bed ran for a number of years, and was finally shut down in 1918. We found it feasible to settle the sewage and reduce the bulk of the sludge in our Imhoff tank, besides obtaining a sludge reasonably easy to dry in five to seven days. The chemical precipitation sludge was in very much greater volume, about twelve cubic yards a million gallons (as against three to six with the other processes) and had a very bad odor.

Experiments were made on fine screening to see how that compared with the tanks. Many claims have been made for the accomplishments of screening, but our experiments, I think, put very clearly before us the relative value of the screening process. We had a little rotary screen about three feet in diameter and five feet long, covered with thirty mesh wire screen. This removed from five hundred to one thousand pounds of dry material per million gallons. When followed with a settling tank, about three times as much solids were removed by the tank, that is after the sewage had been through a thirty-inch mesh screen. That indicates the relative effectiveness of the two processes. In our experiments, later, we tried the twenty mesh screen and with that obtained a removal of between fifty-five and sixty per cent of that obtained by the thirty mesh screen.

In 1914, we made our first report. Early in 1915 we suggested that all the sewage should be collected at a common point, where fine screens should be installed followed by tanks and possibly sprinkling filters. At the time that seemed to be the most available program. We felt that the screening was beneficial and should be used. A few months after the report came out the activated sludge process began to attract attention abroad. Both the packers and the District agreed to try that before determining the final program. A plant was put in service in 1916 and was operated for two years.

The activated sludge process is essentially one of blowing air through sewage. The effectiveness of the process comes from the fact that the sludge or suspended solids which settle are accumulated and made active or effective by storing in contact with air. When these solids or bacterial films are accumulated and blown freely with air, they gradually acquire the property of oxidizing and nitrifying the matter in solution as well as that in suspension. The process is exactly the same as that in the sprinkling filter, except that instead of supporting the films on crushed stone placed in a concrete bed (which is a rough description of a sprinkling filter), the films are held in suspension in water by the air and kept alive by a surplus of air. Hence the action is carried on more intensively than in the sprinkling filter, where the film area is much less and the available air is less.

The sludge is settled out of the sewage as it leaves the aeration tanks, and is returned to mix with the incoming sewage. The contact period may vary from eight to twelve hours, according to circumstances. The incoming sludge acts like yeast in working on the incoming sewage and then is separated out again, there being a constant accretion, due to the new suspended matter coming in. Some of this finally has to be removed from the system. After a while some can be removed every day to keep the proportion of sludge right. When it is active and ripe it has a characteristic brown color. When sick, it becomes black. This must either be removed or else the proportion of air and sewage altered to bring it back. The process is more efficient in the summer, but the summer is the time when the most efficiency is needed in our case.

We operated the testing plant for about two years on the activated sludge process. The plant then consisted of a rotary screen through which all sewage was passed, first with the thirty mesh and then with the twenty, the aeration tanks, of which there were four, through which the sewage flowed with the sludge added to it, and then a settling tank to settle out the sludge, from which tank the sludge was returned to the point of beginning again. We first tried aerating the sewage with the sludge. Later we tried re-aerating the sludge on its return to see if we could make any economies thereby. We found we could reduce the amount of air and the space required for the tanks. Apparently about twelve per cent less area was needed for our tanks on our scheme of working but the complication of the process was increased.

Different types of tanks were used for settling. The Dortmund tank in which the sewage entered near the center and flowed out to the circumference, gave better results than a straight flow tank. An inclined tank gave us by far the greatest efficiency but would be rather expensive to build. In our actual designs we are inclined to use the Dorr tank, which has been used in the mining industry. This is a shallow circular tank in which sludge is slowly pushed toward the center by squeegees in a given number of hours, according to the design, when it can be pumped out. The activated sludge process gave a good removal of the suspended matter and a clear effluent, the best of any of the processes tried. From eighty to ninety per cent stability was secured in the summer, and in the winter from thirty to sixty per cent. The removal of suspended matter was high. Further, the actual sludge removed totaled within eighty-five to ninety per cent of the suspended matter removed, the suspended matter being the solids taken out of the sewage and the sludge being the solids as removed from the tanks. This is considerably closer than other experimental work. It showed that there was not very much digestion of the sludge in these particular tanks.

Based on these general results, in 1917, the engineering side of the problem was investigated. Mr. W. D. Richardson, the Chief Chemist of Swift & Company, was appointed to represent the packers and I was asked to look after the District's end of the investigation. We went into the matter from the standpoint of the actual design and cost of the plant, to care for the entire flow from packingtown. We made a report in 1917 in which we outlined an activated sludge plant to take care of the wastes of the industry. We advocated then the taking of the wastes as they came, but separating them from the domestic sewage of the city. This means an intercepting sewage system, roughly from Halsted Street on the east to Ashland Avenue on the west, into which would come only the waste of the packing industry, with the human sewage from the employes, which could not well be separated. Our survey of the situation indicated that it was not worth while to try and go into packingtown and actually separate the sewage from the sixty thousand employes. It is not a very practical procedure and moreover is not worth the cost, which would be great, on account of the cost of laying pipes, etc., in congested streets.

The intercepting sewers were led to a site at the fork of the east and west arms of the south fork of the south branch of the Chicago River. That site was assumed because the District has the right to use about eight acres there in exchange for the filling up of Bubbly Creek, west of Ashland Avenue. The site is limited in area and means a more expensive plant, probably, than might be built if the area were greater, and is further complicated by railroad tracks belonging to the Chicago Junction Railroad.

There is another site available just to the west between Ashland Avenue and the Armour Mechanical Plant, and south of Thirty-ninth Street. This would entail filling up the bed of Bubbly Creek from Ashland Avenue east to Thirty-ninth Street, a distance of about twelve hundred feet. We think that would be a benefit to everybody and would further benefit the city by opening up Thirty-ninth Street across Bubbly Creek, between Ashland and Halsted Streets, and do away with the necessity of a bridge at that point, which, under the present conditions, would be needed.

The question of a site is still under discussion because of the legal complications in obtaining the necessary permit to fill up a part of the river, which appears not to be a navigable stream in any practical sense, although there is a doubt in the minds of some as to whether it is navigable in a legal sense. The exact site has not been settled. These two are practical, although one is more difficult to develop than the other because of the smaller area.

Mr. Richardson and I further recommended that the plant consist of fine screens, a grit chamber to act also as a grease skimmer, and an aeration tank, followed by settling tanks. The plant would also include filter presses for pressing the sludge in order to remove the water content, which was about ninety-eight to ninety-nine per cent water. To handle the big volume of material it is necessary and desirable to remove the water. Our experiments indicated that the addition of a small amount of acid to the sludge facilitated removal of the water so that with the filter presses we could bring the moisture in the sludge down to between seventy-five and eighty per cent. We further provided rotary dryers in which the cake could be dried to a moisture content of ten per cent and used commercially as a fertilizer. Grinding may be necessary.

This plant was based on certain assumptions derived from our experiments. For the period of contact we took eight hours for the sewage. Four cubic feet of air were assumed per gallon of sewage. For settling tanks we allowed a one hour period. We had some doubts then, in 1917, as to the exact working out of the filter presses. No one had tried this process on a large scale, and knowing from Mr. Richardson's experience in industrial lines, the immense importance of having clean cloths in order to keep the process going, we felt that some further experiments on a large scale were necessary. At that time there was no city operating a large plant. The Houston plant came into service shortly after our report was made, but without any provision for handling sludge. Milwaukee was still experimenting, and so were other cities. We recommended, and I think rightly, at the time, that the plant should be developed progressively, by first installing a screen; I wanted to put it in for the whole flow, Mr. Richardson wanted it for part. All of this meant a working program of from three to five years before the plant could be completed.

During the war the program, of course, had to be largely laid aside because of more pressing matters, but we are now at a point where some definite action should be taken to handle this sewage. It would appear that this progressive plan, with some modifications, perhaps, to increase the size of the unit plant to take advantage of the experience of other cities in their development since 1917, might well be considered. Such a course has been recommended, I think, by some civic bodies like the City Club, which have given the matter brief consideration. Personally, I feel that screens can be put in and operated to a great advantage, removing probably with a thirty mesh screen one-quarter of the total suspended matter. Such a plant can be built and, after the intercepting sewer is finished, operated until the rest of the plant had been built up to its full capacity. We know from experiments in the activated sludge process at Houston, and Mr. Hatton's more recent experiments, that the general principles are correct. The essential part which has to be worked out carefully is the handling of the sludge. That is the real problem in Packingtown.

The importance of exact data is apparent when I mention that, in the estimate of three and one-half million dollars for the complete plant of 1917, the amount required for filter presses was five hundred thousand dollars for one hundred presses. Before the war it appeared attractive enough to cause other manufacturers to desire to investigate, but the war cut short their interest. The amount of electric current is also an important item. The operating expense we estimated, on the whole plant, including interest and depreciation, would be about $850,000, of which the electrical current cost $270,000, which averaged seven-tenths of a cent per kilowatt, according to the then published rates of the

Commonwealth Edison Company. The price was not so high, but the quantity was very great, on account of the four cubic feet of air per gallon required to handle the sewage. Our experiments have not reduced that much below three and a half cubic feet, under more favorable conditions. The labor was not so great, a little less than $100,000 for the operation with labor and supervision. This is not a large proportion of the whole.

In the investigation we found that the material to be recovered had a commercial value. I think that was the reason, largely, why the packers, for the first time in their history, agreed that a sewage treatment process was practical and assented to activated sludge. The District had a great deal of difficulty in interesting them in other processes even though the experimental plant had demonstrated what was practicable. The dried sludge apparently has a sale value sufficient to offset a part of the operating cost, say $200,000 to $400,000 a year. This would not by any means pay the cost of operating including interest and sinking fund, but it would more than pay the cost of recovery of the sludge. This is a very important consideration, because in most sewage processes there is practically nothing recovered of value. In fact many places consider themselves very lucky if a farmer will haul the dried sludge away and perhaps pay ten cents a load for it. The results indicate that with this process there is hope of some commercial return from the plant to reduce the cost of operation. This was a great step in advance, and appealed to the commercial instinct of the packers. Of course that return will depend on the market rate for nitrogen.

There is also some return in the way of grease, but this is difficult to estimate because of the varying amount of grease that is recovered. It amounts, however, to about $20,000.

The program now, so far as construction goes, lies in a statu quo. The District and packers, after negotiating, have determined the proportion each shall pay, namely, forty per cent for the District and sixty per cent for the packers. Little has been done to develop further the engineering features. However, during the progress of this negotiation, about three years ago, one step was taken definitely to clean up Bubbly Creek. The District built an intercepting sewer on the south side of Bubbly Cdeek running from Ashland Avenue west to Western Avenue. The city filled the creek up and so relieved the community of the stench from that source. Today railroad tracks are running over the top of the fill. The Union Stock Yards and Transit Company contributed $25,000 toward the cost of the sewer and gave every facility for getting through their property and network of tracks there. It was a very lucky move, not anticipated at the time, but it probably made possible the construction and use of the Thirty-ninth Street warehouses for the army during the war. The fly nuisance was removed as well as the odor.

In this problem, too, besides the question of treatment of the waste and its collection, there comes in a problem from the city side which has complicated the situation. That is the question of opening up Thirty-ninth Street across Packingtown. There is not a street open across the district lying between Thirty-fifth Street and Forty-seventh Street. To go east or west one must take either one of those streets. Consequently, there has been considerable demand for opening up Thirty-ninth Street. Whether it will be done has yet to be decided, but it has complicated the problem, because it means that a twenty-foot conduit coming from Thirty-ninth Street on the Lake would have to be extended perhaps half a mile from Halsted Street to beyond Center Avenue. Grade crossings are also involved. The most favorable scheme seems to be to depress the street, but that is a question that has to be worked out. If the street is depressed it affects the height of the sewers, which is a critical point.

Mr. Hill, for the city, has further complicated the problem by proposing to build a relief sewer from a point south of the "Yards" along the general line of the present Center Avenue sewer, with about an eleven foot opening at Bubbly Creek, in order to relieve an area subject to flooding, just south of the "Yards." We have favored this because it enables us to separate the industrial waste and keep it in the old Center Avenue sewer.

We then have not only the question of sewage treatment in the engineering problem, but also a question of grade crossing, extension of streets, and new sewers, which has added to the detail that has to be taken care of, involving not only Packingtown, but the Chicago Junction Railway, the Union Stockyards, and the city and ourselves.

Regulation of Street Series Lamps in Practice on Milwaukee's System

By F. A. VAUGHN,
Consulting and Illuminating Engineer for Milwaukee.

[*Editor's Note—This paper was originally delivered at the joint meeting of the Western Society of Engineers and the Illuminating Engineering Soicety, May 27, 1918. Before publishing in this issue, however, the author has made certain revisions in the text, discussion and illustrations which bring the material in the article up to date.*]

THE writer, or his colleagues, has, from time to time, placed on record with the Illuminating Engineering Society and elsewhere:

(1) The theoretical considerations and principles of regulation of street series lamps;

(2) Its development stages;

(3) The application of these principles to practice by means of an installation; and,

(4) Other matters relating to the new street lighting system now in process of installation in the City of Milwaukee.

When the request was made that he present a paper to the joint meeting of the Western Society of Engineers and the Illuminating Engineering Society, it was felt that perhaps it would be of interest to complete the information thus recorded by indicating what success has been met thus far in the above system in the actual operation of street series incandescent lamps on the system, as proposed and actually installed.

Realizing that the system has, at least, some unconventional features which might have a bearing on the actual lamp-performance on the system, great care was taken in planning the details of the system so as to safeguard against any possible unsatisfactory performance and it is to these details that attention will now be directed.

To review and to present an illustration for the purpose of writing concretely on the matter, the schematic diagram of the connections of the street-lighting circuits will be first presented. (Fig. 1.)

Briefly, the plan comes under the classification of the constant-potential series-type of street-lighting distribution sytems. The city is divided into a certain number of approximately rectangular areas, each area containing a complete street-lighting circuit, divided into two or more sub-circuits, or series-loops. Usually, at a point about which four or more of these rectangular areas cluster, a sub-station is located, through which these series street-lighting circuits are connected to the ordinary 2300-volt constant-potential 60-cycle feeders of the public utility company's regular, commercial alternating-current system. The multiple transformers, two sizes of which are shown in Fig. 6, are utilized for this connection between the series-circuits and the constant-potential feeder; adjustment of voltages being made by means of the taps on the primaries and secondaries of these transformers.

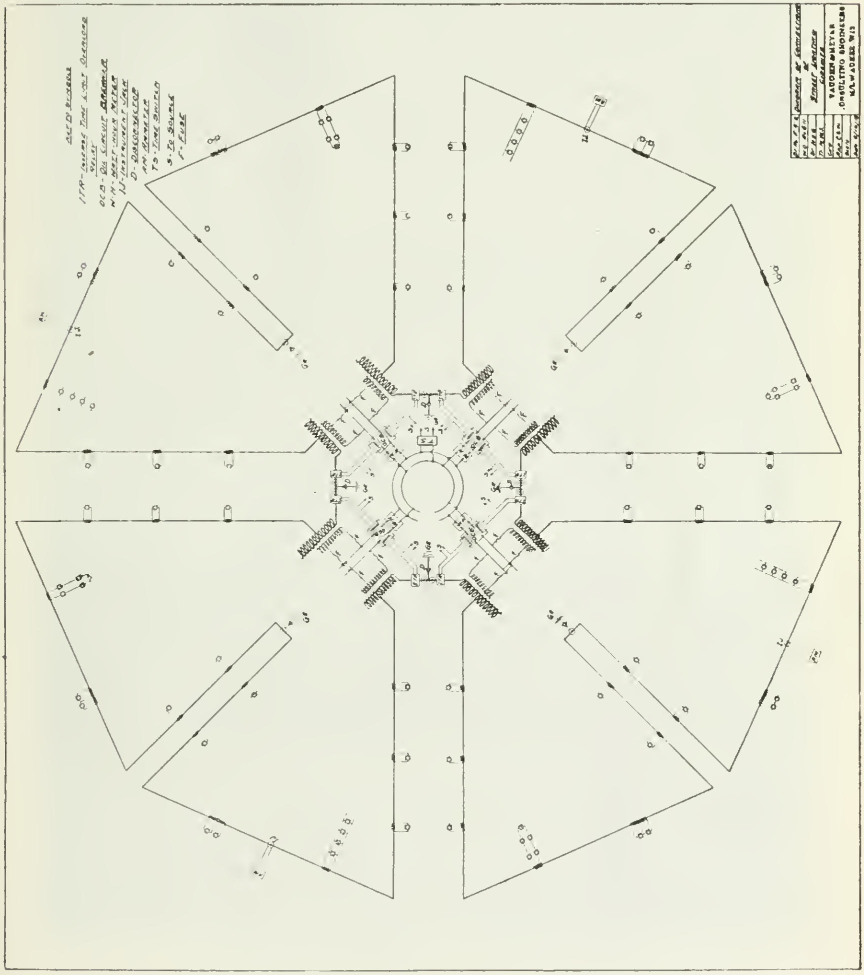

ITR - Inverse Time Limit Overload Relay
OCB - Oil Circuit Breaker
W.H. - Watt-Hour Meter
IJ - Instrument Jack
D - Disconnector
AM - Ammeter
TS - Time Switch
S - To Source
F - Fuse
Diagram of Connections of Street Lighting Circuits
Vaughn & Meyer Consulting Engineers Milwaukee Wis

Figure 1. Diagram of Connections of Street Lighting Circuits.

At these sub-stations are the necessary time-switches for lighting and extinguishing the circuits; the time-limit overload-relays; the oil-circuit-breakers for protection of the various metering devices; the testing connections; and other paraphernalia shown in the photographs of these sub-stations.

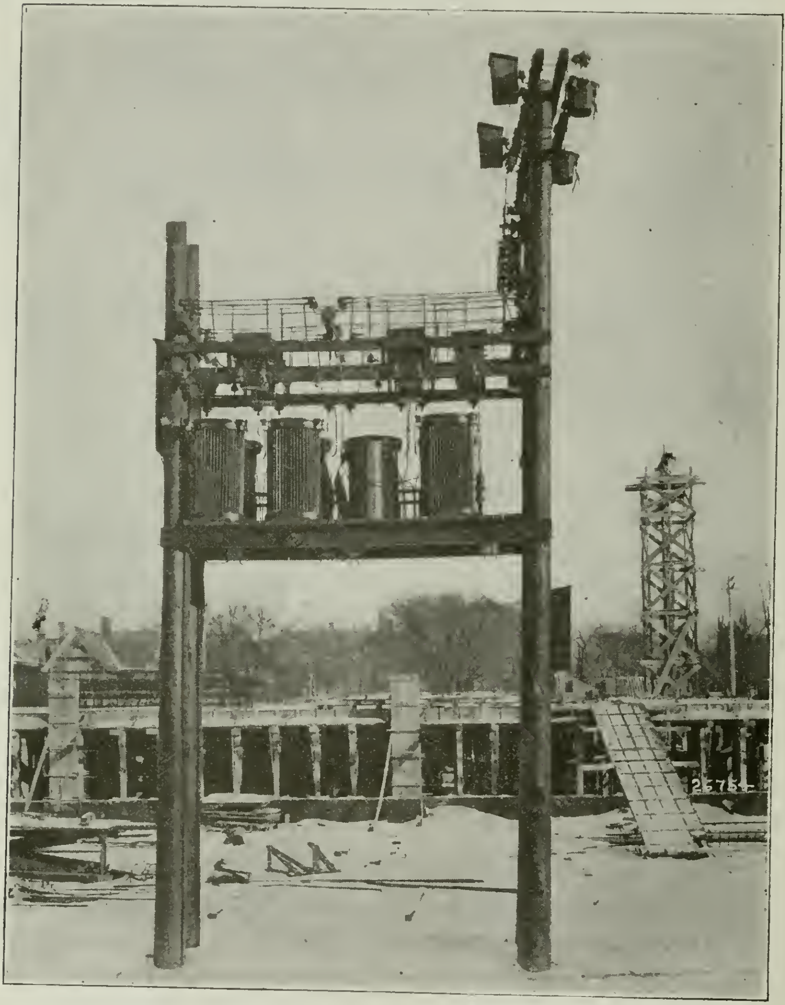


Figure 2. Outdoor Overhead Sub-station "C."

The typical series-circuit may contain various sizes of lamps in single, double and multiple styles of units, all supplied with constant current from the secondaries of series-multiple transformers, placed in the ground at or near the bases of the concrete lamp-post.

Fig. 1 indicates schematically how these units may vary from single-lamp units of any candle-power desired to double-bracket units, supplied by two-coil transformers with common return; or several units in a group fed by a "safety-coil," or group transformer.

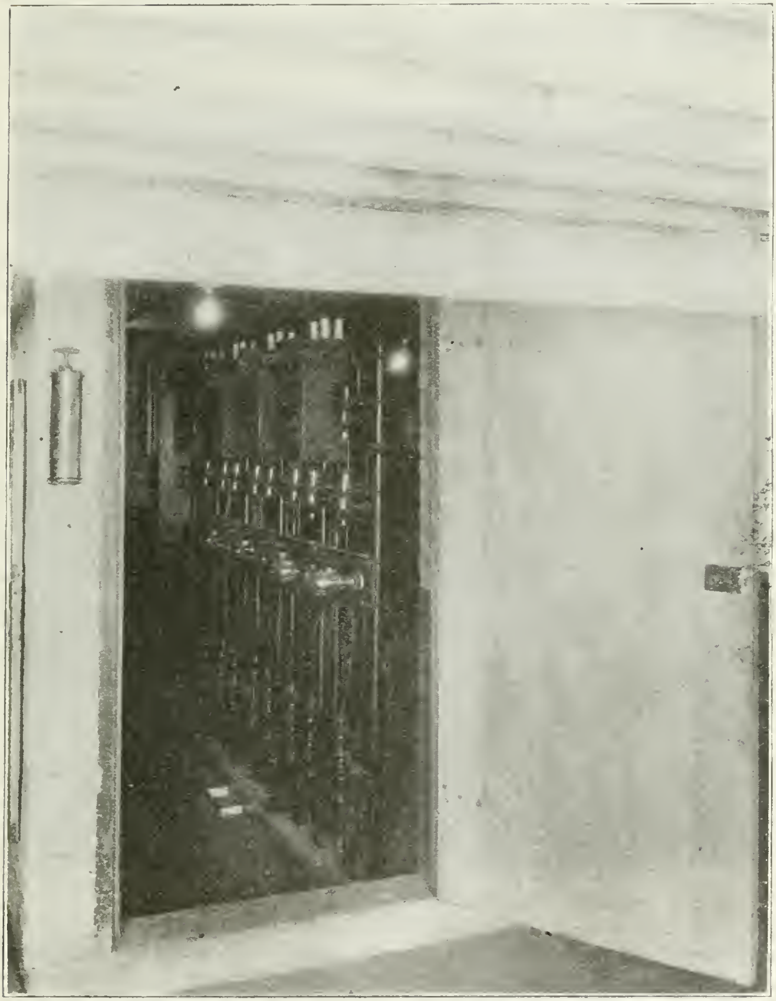


Figure 3. Sub-station Within Fireproof Enclosure in Fire Barn.

The circuits may be divided into as many sections as is desired by increasing the number of transformers and grounding midway between each pair of transformers. This makes it feasible to operate the circuits in a group with only a comparatively small area "out"; the particular loop which is open-circuited being bi-passed through the ground at the station and the ground at the center of the loop; one-half of any given loop being the maximum number of lamps "out" due to any single case of open-circuiting.

The apparatus indicated in the central portion of the diagram consists of primary transformers, oil-circuit-breakers, overload-relays, time-switches, disconnecting pot-heads and such apparatus as originally was included in the sub-station, and represents what is actually known in this system as a "sub-station."

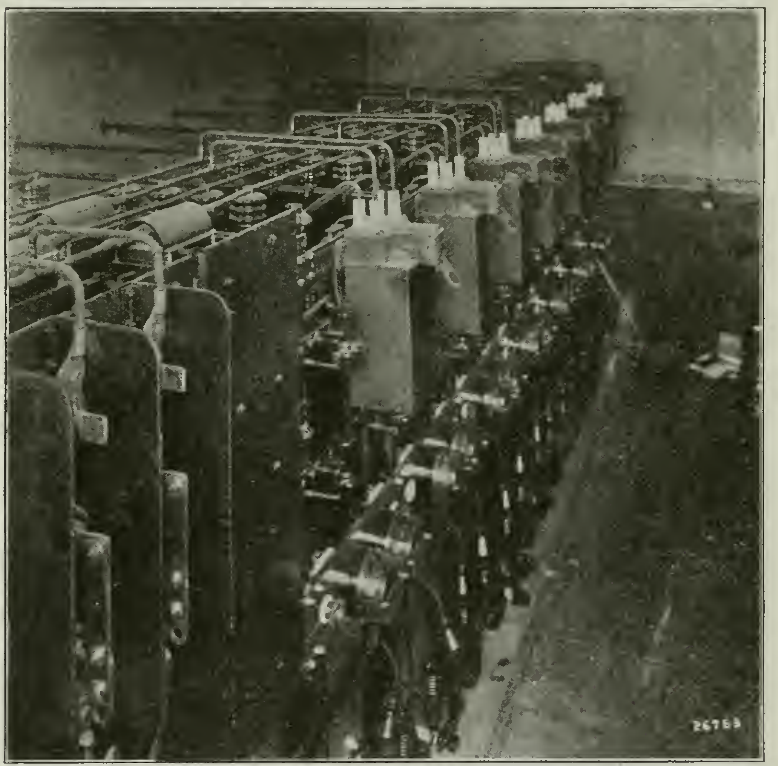


Figure 4. Arrangement of Apparatus in Sub-station in School Building.

There are a number of these sub-stations in various parts of the city, each of which controls a number of circuits, as indicated by the diagram and these sub-stations have been designed and developed in three forms—(1) overhead, on poles (Fig. 2); (2) on the ground—in buildings, either present or specially designed for the purpose (Fig. 3); (3) underground, in manholes or basements.

School houses, fire departments, Auditorium building, City Hall and other public buildings are largely used for this purpose (Fig. 4).

To indicate how simply these sub-stations can be constructed and installed, the illustration (Fig. 5) shows the first overhead sub-station which was hurriedly, but carefully, installed for the purpose of controlling the entire original demonstration installation, April, 1915, and is still operating satisfactorily. The permanent sub-stations (Fig. 2) present a neater appearance and are more complete in design and more permanent in construction, but of the same general type, when placed overhead.

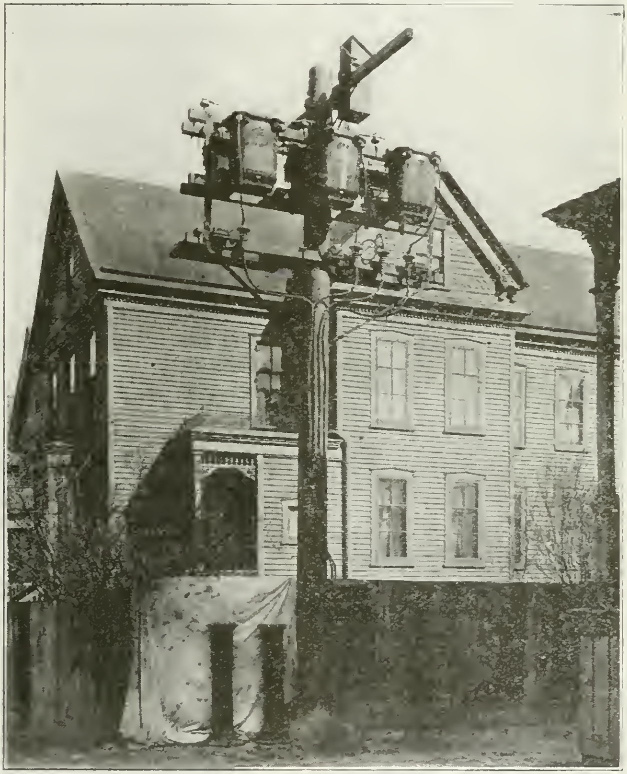


Figure 5. First Overhead Sub-station Installed. (April, 1915.)

Realizing that the conventional type of street-lighting sub-station, controlling a section of this character, would contain some type of movable-coil regulator, attention is called to the fact that nothing of this nature exists in this sub-station. The transformer utilized (Fig. 6) while of special design in regard to certain features, was actually not designed as an automatic regulator for the circuit, but as an efficient means of transformation from the voltage required by the series secondary circuit, which latter voltage is dependent upon the number and wattage of the street-lighting units connected in series. Its main use and feature is its multiplicity of taps on the primary and secondary coils for the purpose of manual adjustment of the average ratio of transformation so as to accommodate any transformer to the voltage required by the series secondary circuit, either initially or as the circuit may be extended or developed. There are, therefore, on each transformer six taps on the primary coil and thirteen taps on the secondary coil, arranged to produce voltages as shown in the following tables. (Tables 1a, 1b and 1c.)

TABLE 1a.

TAPS AND CONNECTIONS ON 16.5 KV. A. MULTIPLE—MULTIPLE TRANSFORMERS.

Primary Connections		Secondary Connections	
Lines on	Volts	Lines on	Volts
1 and 2	2000	8 and 9	1965
1 and 3	2075	8 and 10	2005
1 and 4	2150	8 and 11	2040
1 and 5	2225	8 and 12	2085
1 and 6	2300	8 and 13	2125
1 and 7	2375	8 and 14	2170
		8 and 15	2215
		8 and 16	2260
		8 and 17	2305
		8 and 18	2350
		8 and 19	2400
		8 and 20	2450
		8 and 21	2500

TABLE 1b.

TAPS AND CONNECTIONS ON 10.25 KV. A. MULTIPLE—MULTIPLE TRANSFORMERS.

Primary Connections		Secondary Connections	
Lines on	Volts	Lines on	Volts
1 and 2	2000	8 and 9	1220
1 and 3	2075	8 and 10	1245
1 and 4	2150	8 and 11	1270
1 and 5	2225	8 and 12	1295
1 and 6	2300	8 and 13	1320
1 and 7	2375	8 and 14	1345
		8 and 15	1370
		8 and 16	1400
		8 and 17	1430
		8 and 18	1460
		8 and 19	1490
		8 and 20	1520
		8 and 21	1550

TABLE 1c.

TAPS AND CONNECTIONS ON 4.125 KV. A. MULTIPLE—MULTIPLE TRANSFORMERS.

Primary Connections		Secondary Connections	
Lines on	Volts	Lines on	Volts
1 and 2	2000	8 and 9	380
1 and 3	2075	8 and 10	460
1 and 4	2150	8 and 11	475
1 and 5	2225	8 and 12	490
1 and 6	2300	8 and 13	505
1 and 7	2375	8 and 14	520
		8 and 15	535
		8 and 16	550
		8 and 17	565
		8 and 18	580
		8 and 19	595
		8 and 20	610
		8 and 21	625

Roughly speaking, the ratio of the transformers is one to one with fractional adjustments, and they are built for nominal voltage

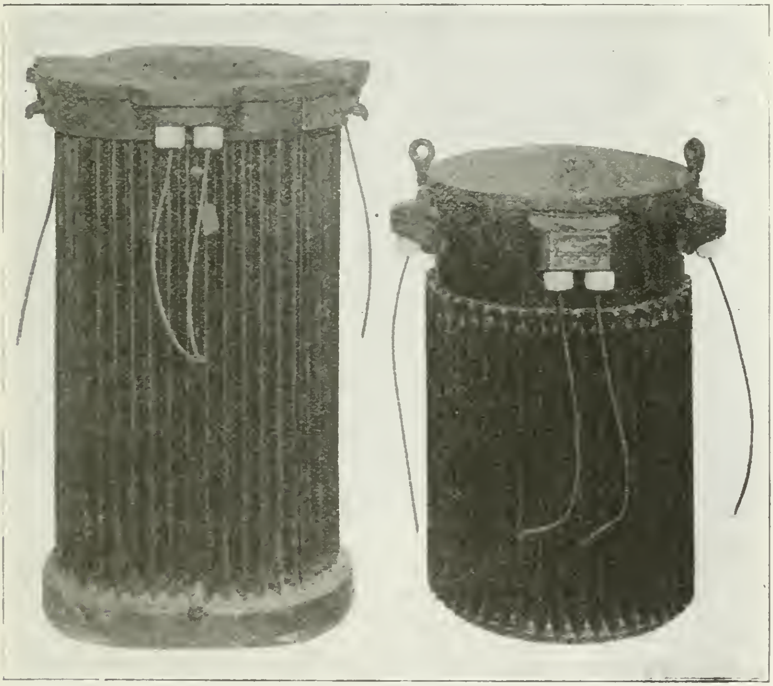


Figure 6. Two Sizes of the Main Transformer Used Between Constant Potential Service and Main Series Circuit.

of 2300 volts, and in three sizes, namely, 16.5 kv. a., 10.25 kv. a., and 4.125 kv. a. While every effort was made in their design to produce a high grade, efficient transformer, the details of their design do not, it is believed, possess sufficient novelty to make their description interesting. It is sufficient to note that these transformers do not perform the usual regulation functions expected of primary street-lighting transformers in the ordinary practice.

At these sub-stations are also located certain other small apparatus which performs important functions on the system, such as time-switches, which automatically turn the lighting circuits on and off and the protecting devices supplying the necessary protection against grounds and short circuits on the system.

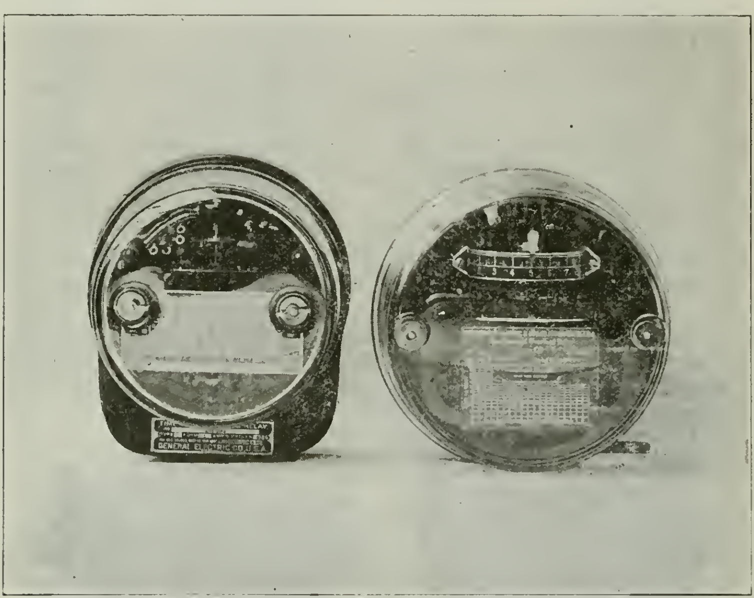


Figure 7. Overload, Induction Type, Inverse Time Limit Relays.

In connection with these instruments, which include recording volt-meters, recording ammeters, cut-outs, relays, etc., the most interesting is, undoubtedly, the time-limit overload-relay which is used to protect the lamps against wholesale burn-outs through grounding. The illustration (Fig. 7) shows one of the General Electric type and one of the Westinghouse type, both of which have been successfully used for the purpose.

It may be stated that the loss of lamps, through this cause, is practically nil. The induction-type relay used gives very satisfactory range of inverse-time and current adjustment. This adjustment has been checked periodically and has been found to remain most constant.

In case short-circuits or grounds do occur on the cable, which as has been explained in detail in previous articles, and which can be seen from the schematic drawing just referred to, are isolated and restricted to small parts of the circuits, the trouble can be located very quickly through the agency of various inspections and exploring-coil type of test-sets and other instruments which can be inserted into the circuit at various points through the use of the

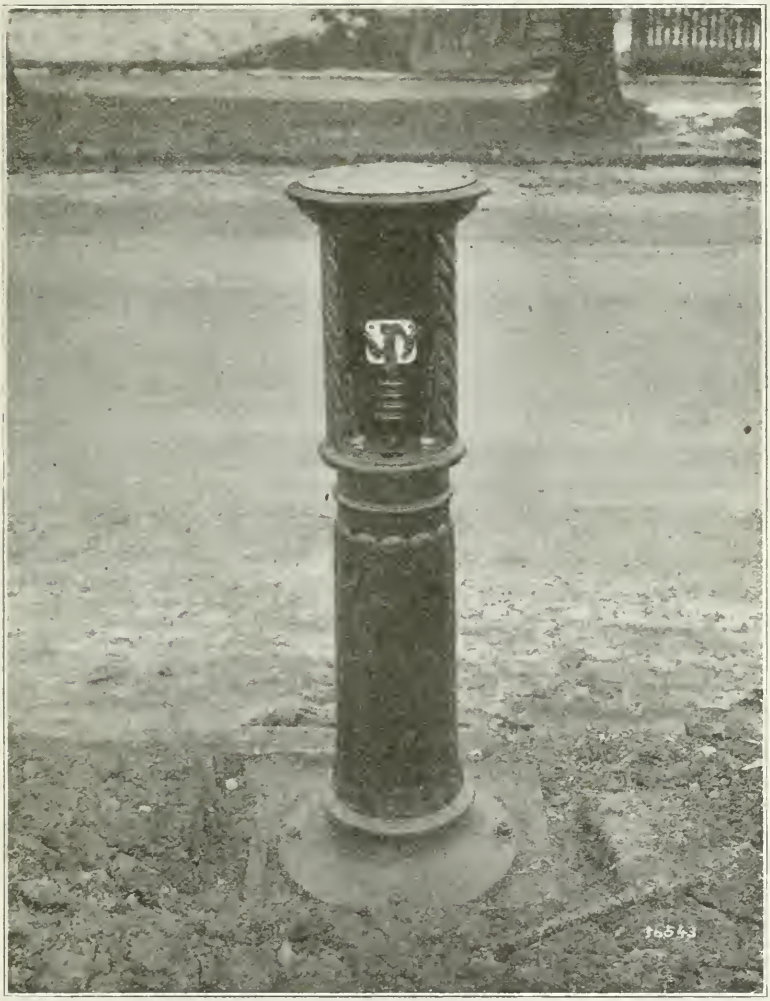


Figure 8. Test Station on Series Circuit. Installed in Abandoned Fire Alarm Box Pedestal.

test stations to be seen in illustration of the overhead sub-station in Fig. 5, and individually in Fig. 8.

If the trouble is in a lamp fixture, or upperworks of the post, it can be reached by means of extensible platform electrically drawn trucks, which have also been referred to and illustrated in previous articles. (Fig. 9.)

The almost entire absence of trouble thus far on the system has made the outages on this system practically negligible. Individual

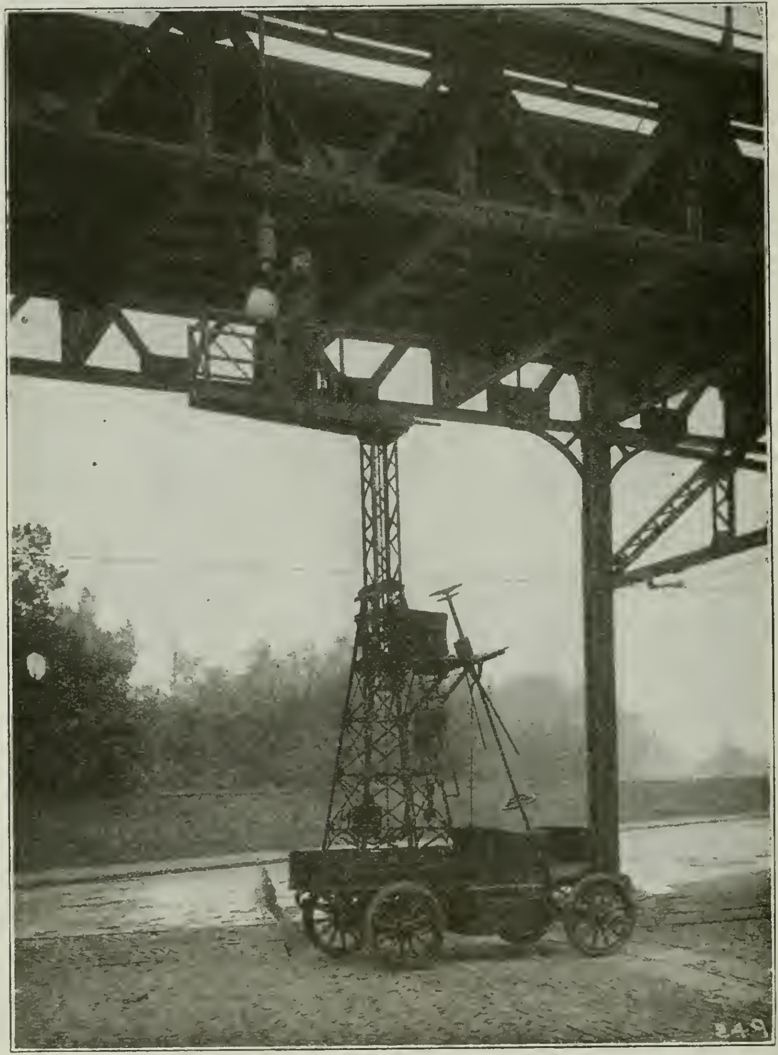


Figure 9. Type of Storage Battery Propelled, Motor-operated Truck for Replacement and Operation, as In Use in Philadelphia.

lamp burn outs, as can be seen by the schematic diagram (Fig. 1), do not, of course, affect the balance of the system or circuit, unless there should be an unusually large number of lamps burn out in one series, in which case, even then, the circuit is self-regulating to such a degree as not to affect the illumination under any reasonable conditions, and in any case, as more and more lamps burn out, the lamp filament current gradually reduces, so that, under extreme conditions, the circuit is self-protecting and the lamps are not subjected to excessive current. The illumination, of course, drops, at first very slightly, then more rapidly, following, naturally, the characteristics of the filament of the gas-filled tungsten lamp.

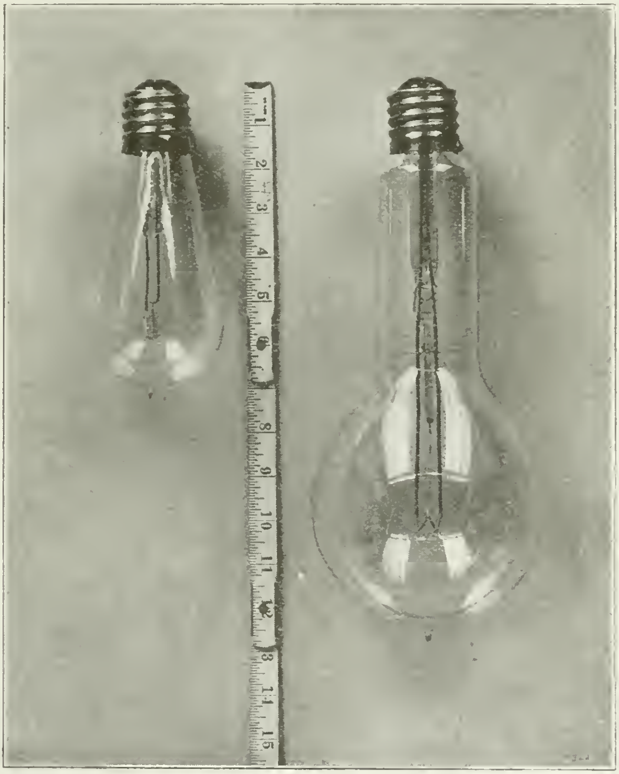


Figure 10. Range of Sizes of Gas-filled, Tungsten-Filament Incandescent Lamps, Showing Relative Size of 100 Candlepower and 1000 Candlepower.

Fig. 10 shows the type and range of sizes of the incandescent gas-filled tungsten filiment lamps used. The sizes used are 100, 250, 400, 600 and 1000 candle power.

In order to produce a line of transformers which would make certain operations on the proposed system satisfactory to the consulting engineer and produce as near to constant current regulation as a manufactured product could make it, a great deal of time and attention has been given to the developing of the line of transformers finally adopted and purchased for this system.

An illustration (Fig. 11) is given of one of the original attempts at this transformer design which, however, was afterwards further developed, as will be seen by the subsequent illustration. (Fig. 12).

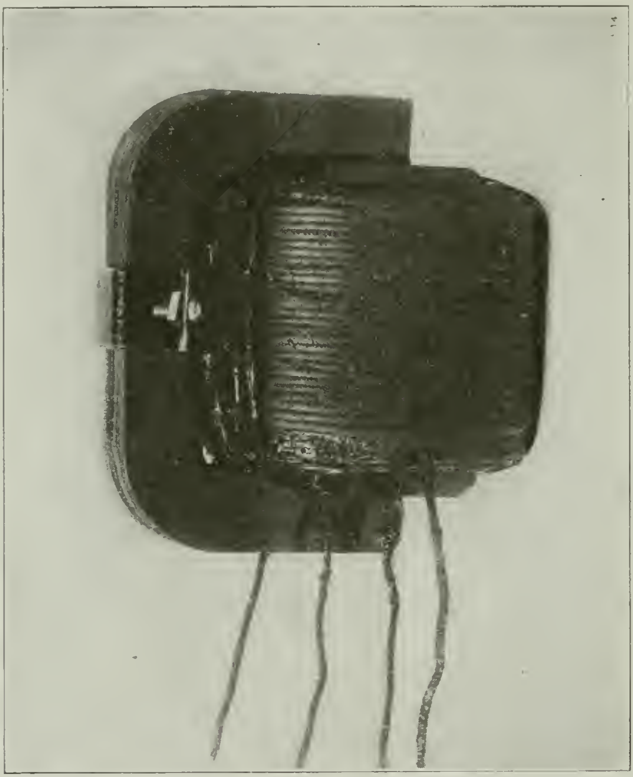


Figure 11. An Early Design of Lamp-transformer for a Series-circuit.

Fig. 12 shows the changes in the original design which were made to finally bring about the complete line of transformers represented in the illustration of the five sizes. (Fig. 13.)

Sizes I, II and III are rated at 6.6 amperes, secondary current, and sizes X and XX are rated at 20 amperes, secondary current.

These transformers have been designed, manufactured and tested with the utmost care, the city's representatives supervising and inspecting every change and item during the manufacture and testing. The manufacturer's engineers, management and factory co-operated very effectively in the production.

A method of testing these transformers in the factory has been devised, whereby extreme accuracy in the measurement of current variations can be accomplished, the method being differential so that the variations from standards of the specifications were actually read to an accuracy of 1/1000 an ampere.

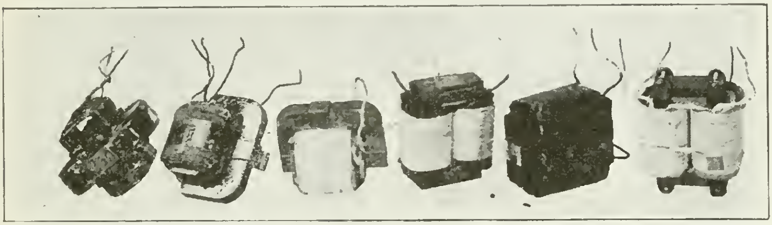


Figure 12. Transitory Designs Used in Development of Lamp Transformer for Series Circuit.

In order to anticipate the possibility that a change in the desired intensity of illumination on any given street might be desired, either due to increased traffic, change of type of business or buildings on the street, the series-multiple lamp-transformers for this sytem were designed with a view to making their overload and underload characteristics rigidly conform to good practice under such anticipatory conditions. Therefore, Size I transformer was so designed that its 100% point falls between the load of a 100-candle power lamp and that of two 80-candle power lamps in series. It, however, was also designed to operate with the next largest sized lamp in the system, namely, 250 candle-power, so that the Size II transformer was built for both the 250-candle power, 6.6-ampere lamp and the 400-candle power 6.6-ampere; Size III for the 400-candle power 6.6-ampere lamp and the 600-candle power 6.6-ampere lamp; Size X for the 600-candle power 20-ampere lamp and the 1000-candle power 20-ampere lamp; and Size XX for the 1000-can-

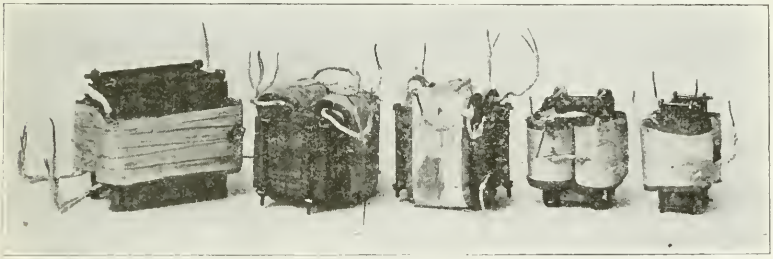


Figure 13. Final Standardized Design of Lamp Transformer in Five Sizes, Without Case.

dle power 20-ampere lamp; and an overload range up to the equivalent of a 1700-candle power 20-ampere lamp.

Figure 14 is a chart showing the per cent load on series-multiple transformers and regulation of same for various lamp loads.

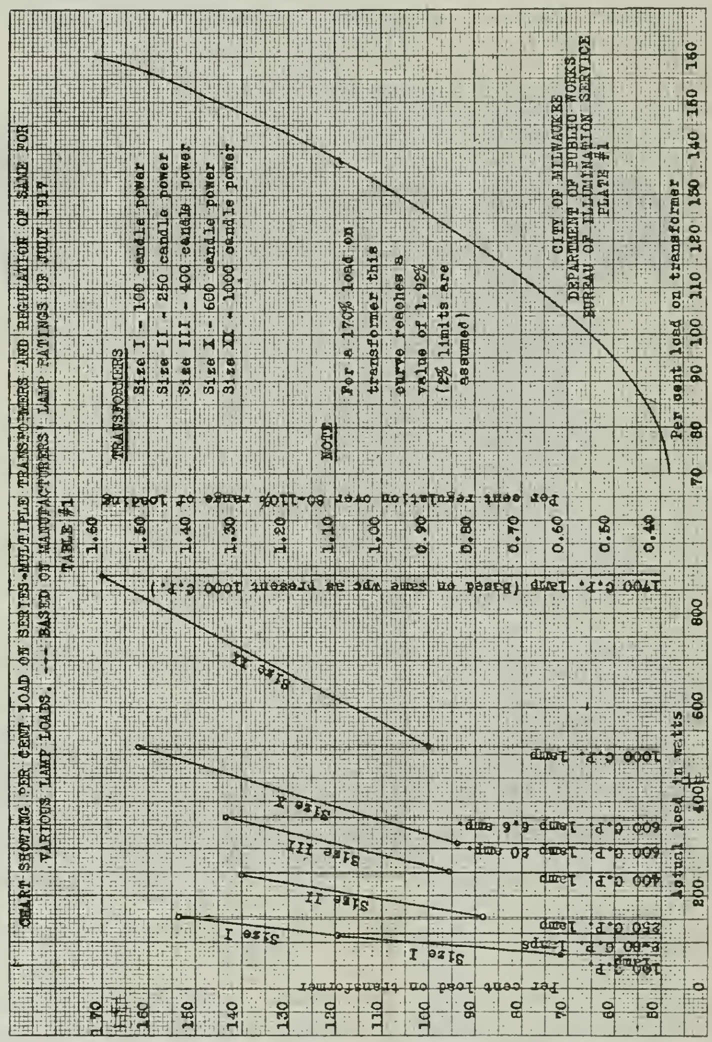


Figure 14. Load Characteristics of Lamp Transformer for Series Circuit.

The left-hand half of the chart shows the per cent load on the transformer of any given size and the actual load in watts with any given candle power rate of lamp for which that transformer was designed. For instance, Size II transformer will operate at approximately 88.5% of full load with a 250-candle power lamp in the socket, and at approximately 140% load with a 400-candle power lamp in the socket, and so on through the other sizes.

The right-hand half of the chart is used as follows: Suppose we select the 400-candle power lamp, to be used on Size II transformer. We find that this will be an 140%-load on the transformer. Now, passing to the right-hand half of the chart, and reading vertically above 140% on the curve, we find that the per cent regulation over 80-110% range of loading with 400-candle power lamps in the socket will be 1.14%. This means that even when

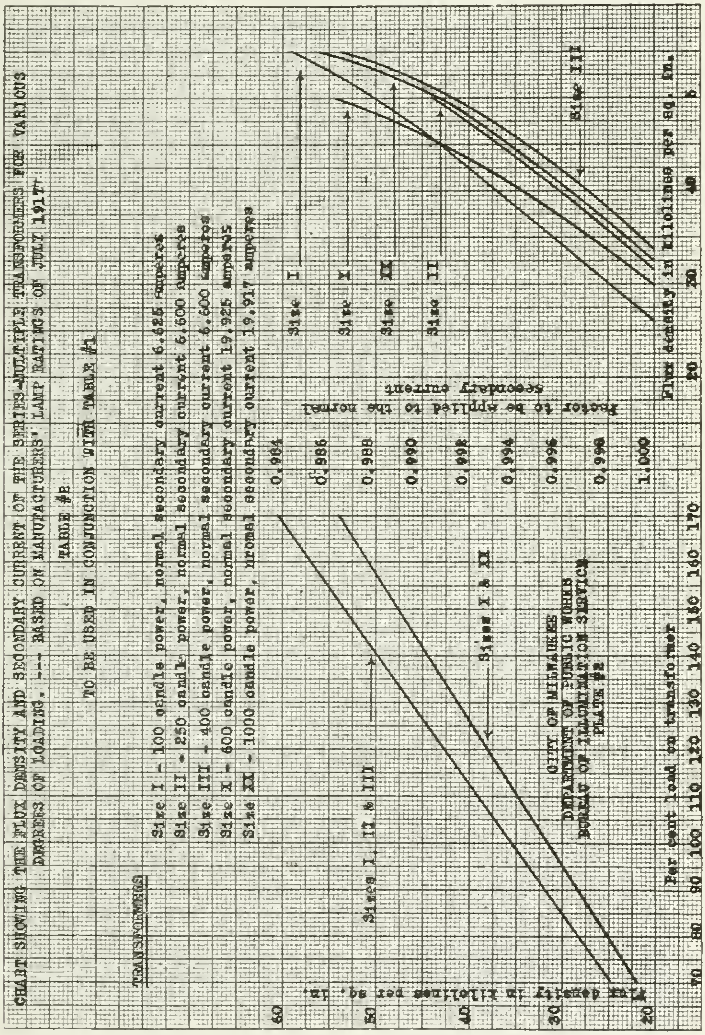


Figure 15. Magnetic Characteristics of Lamp Transformer for Series Circuit.

using the size larger lamp than the transformer is normally rated for, and allowing these lamps to vary in their individual wattage consuming characteristics over a range of 80-110% of normal, the per cent regulation of this transformer will be within 1.14%.

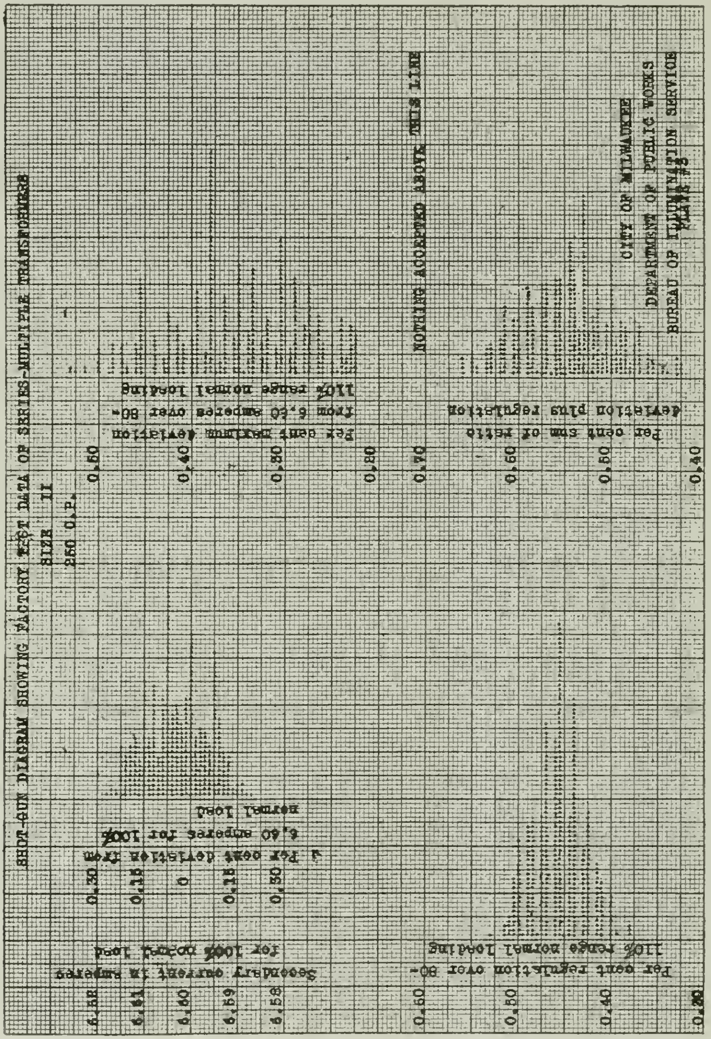


Figure 16. Factory Test Data of Lamp Transformer for Series Circuit. Size II—250 Candlepower.

Figure 15 is a chart showing the flux density and secondary current of the series-multiple lamp transformers for various degrees of loading. From this chart, we may read that with 140% load on the transformer, of either size I, II or III, the flux density in kilolines per square inch is approximately 50. With this flux density of 50 kilolines per square inch, through the medium of the right-hand curve for Size II, we read a factor of 0.9904. This factor, when multiplied by the normal secondary current of 6.6 amperes, for Size II transformer, will give the actual secondary current of 6.53664 amperes. This is the current that will actually flow through the filament of the 400-candle power lamp, when burned on the Size II, or 250-candle power transformer.

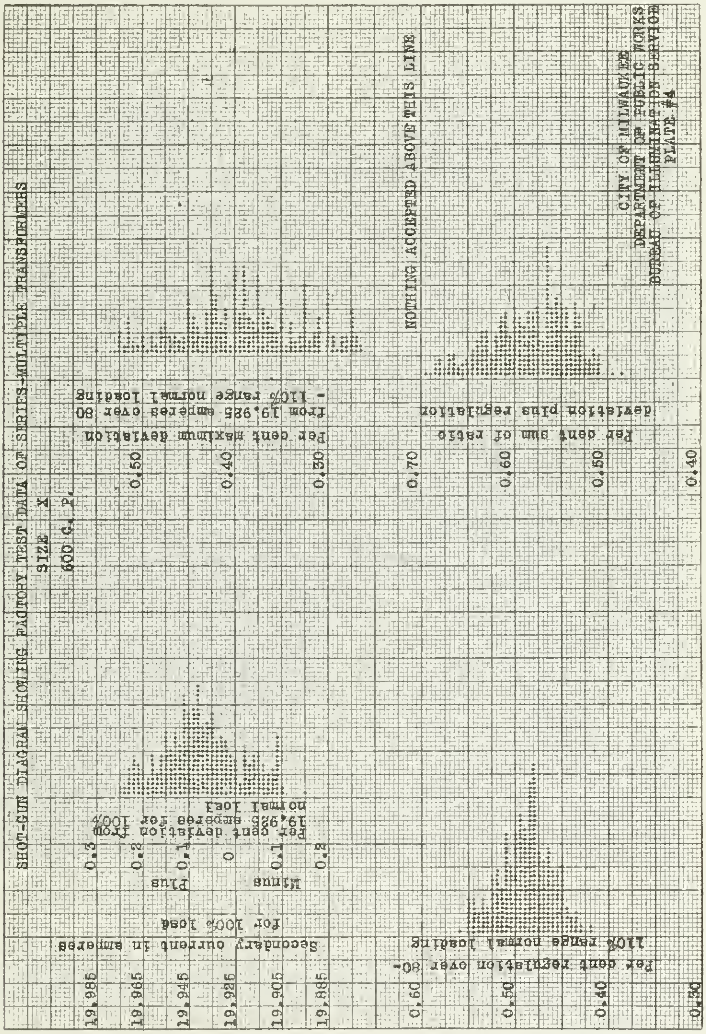


Figure 17. Factory Test Data of Lamp Transformer for Series Circuit. Size X—600 Candlepower.

After completing the electrical and mechanical design of the coils and deciding upon the actual requirements, as shown by the above chart, as well as the method of testing the manufactured product for compliance with these requirements, the results actually produced by the coils put out by the factory were recorded on "shot-gun" diagrams (Figs. 16 and 17) (which are really not, technically speaking, "shot-gun" diagrams), showing the factory test-data for individual transformers.

In explanation of these "shot-gun" diagrams, let a Size II transformer be selected. Figure 16 contains the data for this size. Each dot on the diagram represents a transformer. The compliance of the factory's output, as determined by actual test at the factory, is indicated by the relative positions of these dots in the four groups in this diagram.

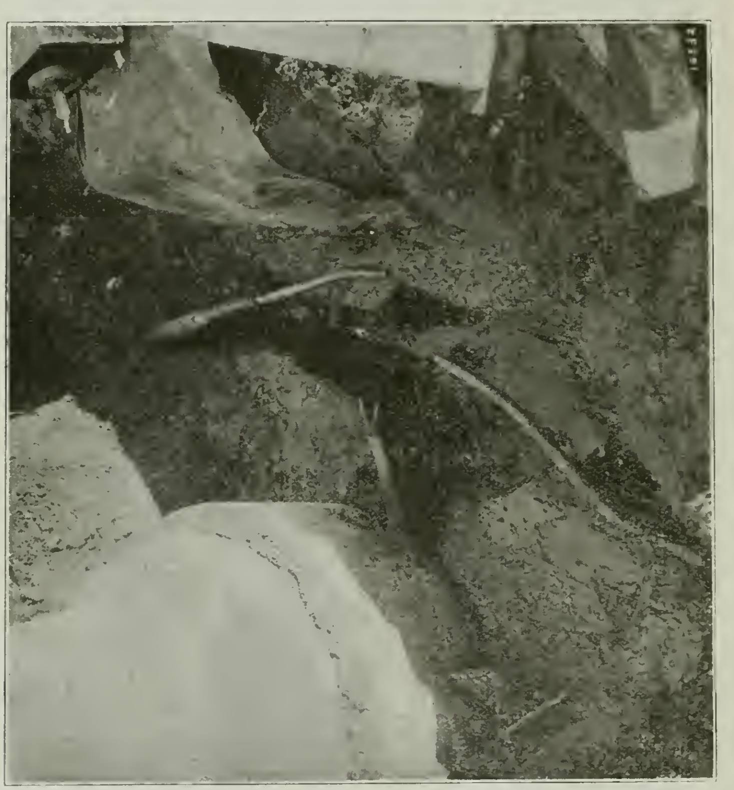


Figure 18. Concrete Receptacle for Steel-encased Lamp Transformer at Base of Lamp Post. Cables Ready for Connection.

Since, according to the table on Fig. 15, the normal secondary current for this size transformer with 250-candle power lamp is 6.6 amperes, all transformers which are perfect as far as ratio is concerned, will be grouped along a horizontal line indicated by 6.6 amperes, all transformers having any other ratios will be grouped at positions relatively above or below this line, according to their per cent deviation from 6.6 amperes, with 100% normal load.

For the group of transformers shown on Fig. 16, the success of the factory output is indicated. Observe that this scale is very open and the fluctuations, therefore, are really very small, as indicated by the figures representing the per cent deviation from 6.6 amperes.

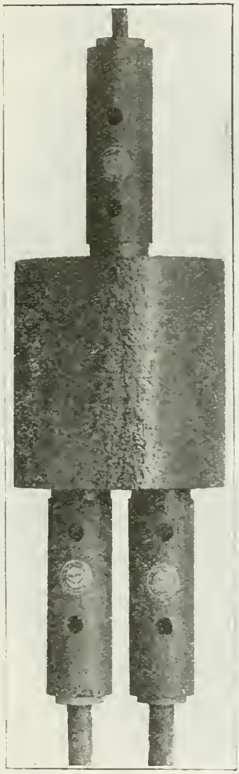


Fig. 19

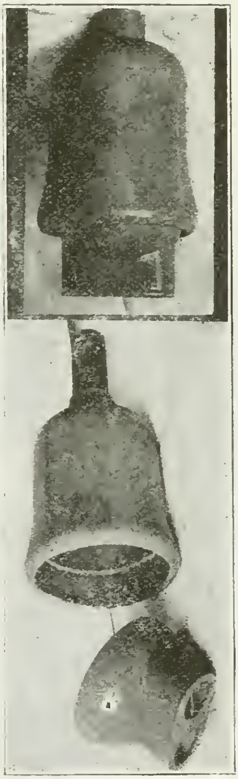


Fig. 20

Figure 19. Bituminized Fiber Conduit Transformer Case.
Figure 20. Glazed Earthenware Transformer Case.

The lower left-hand group represents the variation in the actual transformers produced by the factory, as expressed in per cent regulation over the 80-110 per cent range of normal loading. This is the range specified in the specifications which was so specified in anticipation of possible variation in the electrical characteristics of individual lamps.

The upper right-hand group of points gives the per cent of maximum deviation from 6.6 amperes over the 80-110 per cent range of normal loading. This maximum deviation is thus recorded as distinguished from the actual per cent regulation shown in the lower left-hand group of points, which latter gives the total range of regulation.

In the lower right-hand group of points is plotted the per cent of the ratio deviation plus the regulation, which it was assumed would represent the worst doncition that could be anticipated from such a transformer operating with the regular production of 250-candle power lamps.

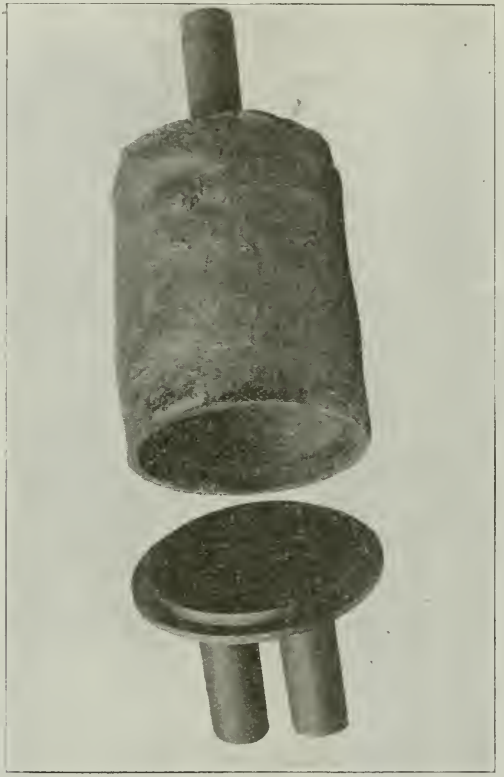


Figure 21. Molded Bituminized Fiber Transformer Case.

A maximum limit of this last variation was set at 0.70%, and nothing was accepted above this line in any size of transformer.

As has been set forth elsewhere in the description of this system, the series-multiple lamp transformers are buried in the ground at, or near, the base of the lamp post. The initial design of these transformers, as used in a so-called "demonstration circuit," embodied a steel case with lead sleeves for connection to the lead cable sheath and their installation is illustrated herewith. (Fig. 18.)

While this design was made electrolysis-proof by placing the case, as illustrated, in a concrete pocket and surrounding it with compound, further developments of the insulated type of case have been accomplished, with the result that impregnated wood and bituminized fiber cases are now employed, as illustrated. Heavy pottery cases have been designed. (Figs. 19-20-21-22-23.)

The care and attention given to these series-multiple transformers was justified, for the resultant circuit operating characteristics are very satisfactory, as the whole object of such development was to secure performance from the gas-filled tungsten-filament incandescent lamp, which will give the desired illumination on the streets and will maintain it as dependably as possible, and, under all normal operating conditions, at high efficiency.

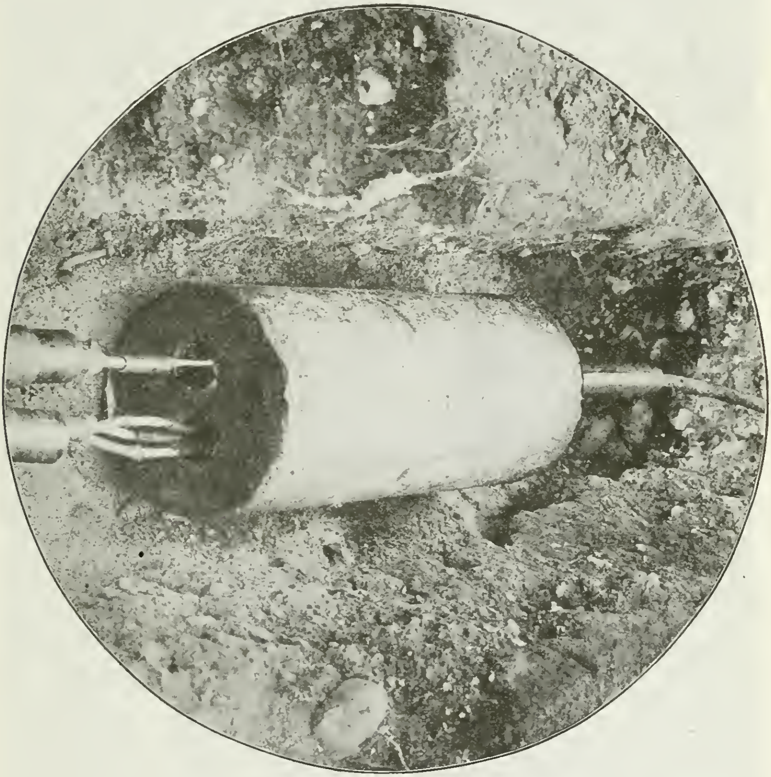


Figure 22. Wooden Conduit Transformer Case, Electrical Connections Completed.

It will be remembered that the system utilizes the gas-filled tungsten-filament incandescent street lamps in sizes from 100 candle power to 1000 candle power. Some of the sizes rated at 6.6 amperes and others at 20 amperes.

These lamps are in no way specially designed for this system, but are a standard street lighting series type with no special or exceptional specification requirements. The engineer felt that a system should be so designed and so operated that the ordinary types of lamps, with perhaps, comparatively wide variations in characteristics could be utilized, with considerable resultant economy.

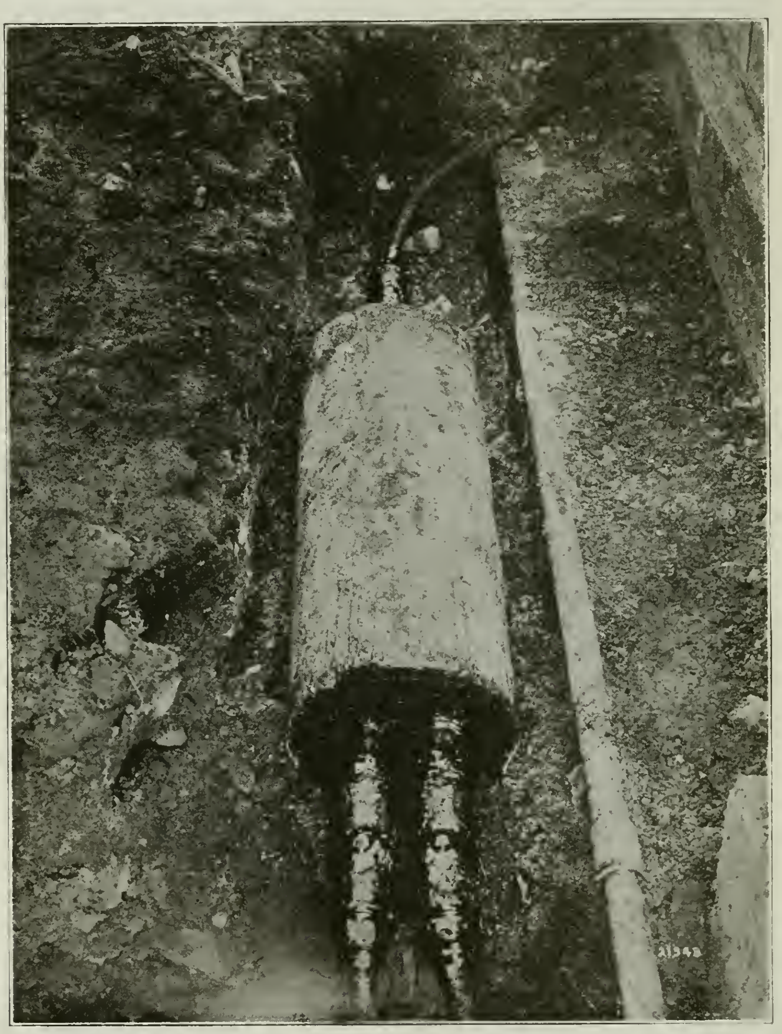


Figure 23. Wooden Conduit Transformer Case, Ready to Bury.

If, therefore, the value of the current in these incandescent lamps can be maintained reasonably constant under the usual conditions of operation of the public utility company's commercial lighting, 2300-volt, primary system, on which these circuits are connected, the illumination of the streets will remain satisfactory as to continuity, uniformity of distribution and intensity, and the results of the operation of the system, from the standpoint of illumination, as well as from the standpoint of lamp life and lamp cost, will be satisfactory. These results have been realized in this Milwaukee installation to a most encouraging degree.

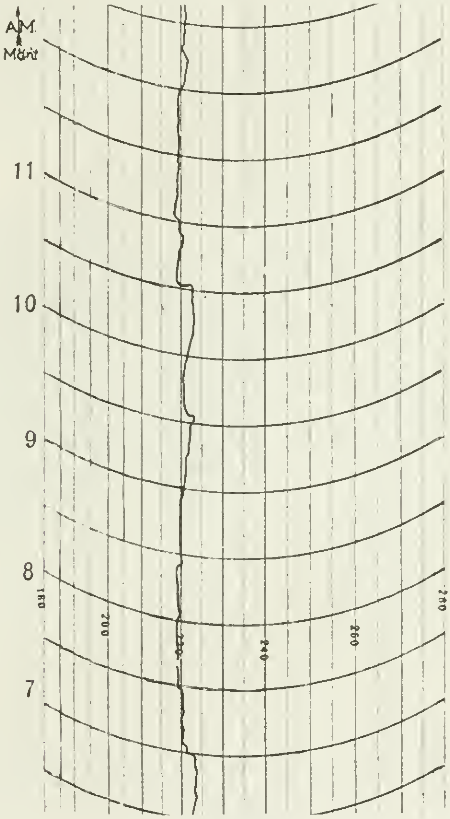


Figure 24. Graphic Recording Voltmeter Chart.

Two illustrations of the graphic recording voltmeter chart and the graphic recording ammeter chart are given, voltage taken at the 2300-volt primary of the primary transformer representing the system feeder voltage, and the current chart taken in the secondary or series circuit of the system. As these are typical, without special selection, it is felt that the results obtained on this system should be gratifying. (Figs. 24 and 25.)

These results are reflected, of course, in another way, namely, in the lamp life and number of burn outs on the system. The lamp record, in card file form, is kept and ilustrated herewith. (Fig. 26.) While this record illustrates the lamp life on a single unit, the following table gives some idea of the average lamp life secured. These are records of lamp life to burn out, and are given as evidence of good overall regulation on this system. (Table 2.)

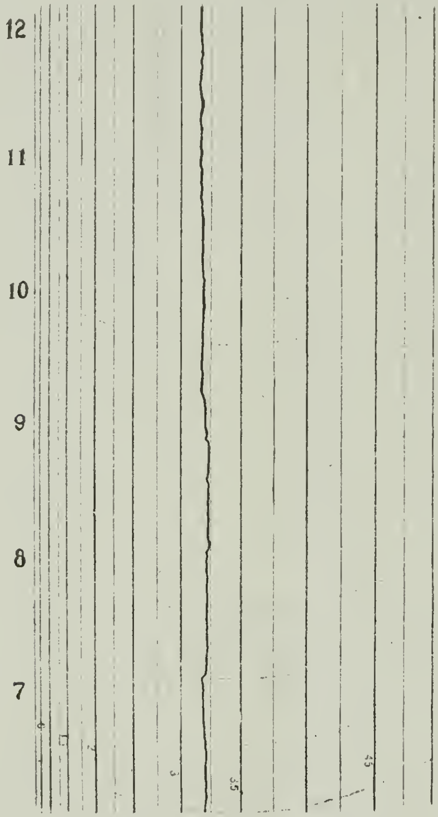


Figure 25. Graphic Recording Voltmeter Chart.

TABLE 2.
LAMP LIFE.
(Average of about 75 lamps of each size.)

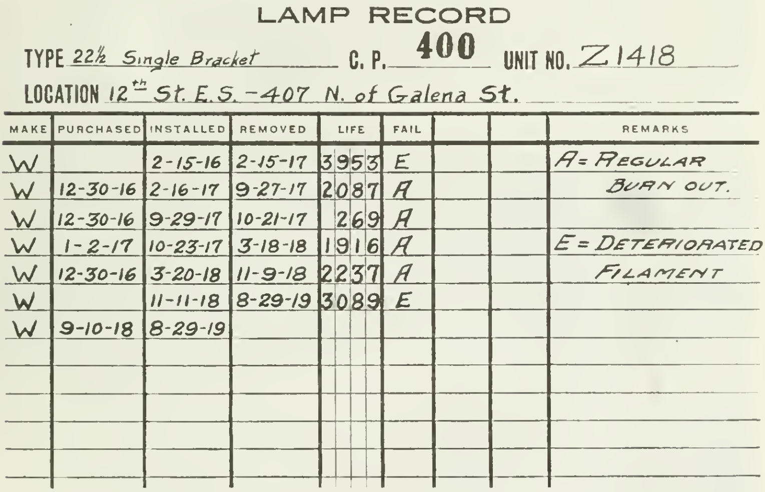
Size	Life
100 candle power	2600 hours
250 candle power	3800 hours
400 candle power	2380 hours
600 candle power	1800 hours
1000 candle power	2680 hours

It is felt that these results fully meet the anticipations of the designing engineers as well as the public, and these ideas have therefore been adopted and incorporated in the system, the installation of which is now about 40% completed.

It is thought that possibly some part of this audience, although the matter has been, as before stated, set forth in numerous other places, might not be familiar with the actual installation in Milwaukee, so a few typical illustrations, showing the actual physical aspect of the installation are here given. (Figs. 27-28-29.)

The installation and operation of this system is accomplished by the city through its Bureau of Illumination Service, which is responsible for the good results obtained.

The writer wishes to acknowledge the assistance given him by the members of the Bureau in the preparation of this paper, and of the splendid engineering work accomplished by them in the installation and operation thus far. The Superintendent of Construction, W. W. Rumsey, has charge of the installation and maintenance, and the sub-station photographs give splendid examples of his work. The Illuminating Engineer, Howard F. Ilgner, has charge of the circuit layouts, location of units, lamp records and illumination problems, which have been illustrated herein. The Laboratory Engineer, Herbert M. Poust, has charge of testing and laboratory work, and has paid particular attention, thus far, to the design and output of the transformers, with the success shown in the accompanying diagrams.



LAMP RECORD

TYPE 22½ Single Bracket C. P. 400 UNIT NO. Z1418

LOCATION 12th St. E.S. - 407 N. of Galena St.

MAKE	PURCHASED	INSTALLED	REMOVED	LIFE	FAIL			REMARKS
W		2-15-16	2-15-17	3953	E			A = REGULAR
W	12-30-16	2-16-17	9-27-17	2087	A			BURN OUT.
W	12-30-16	9-29-17	10-21-17	269	A			
W	1-2-17	10-23-17	3-18-18	1916	A			E = DETERIORATED
W	12-30-16	3-20-18	11-9-18	2237	A			FILAMENT
W		11-11-18	8-29-19	3089	E			
W	9-10-18	8-29-19						

Figure 26. Lamp Record Card File Form.

The balance of the Bureau is composed of men, especially picked for their skill and expertness in a given line. The smoothness and uneventful operation of the system for approximately four years, during which time construction was progressing simultaneously, indicates, it is believed, not only the soundness of the fundamentals involved in the conception and design of the system, but the practicality of its simplicity and ruggedness.

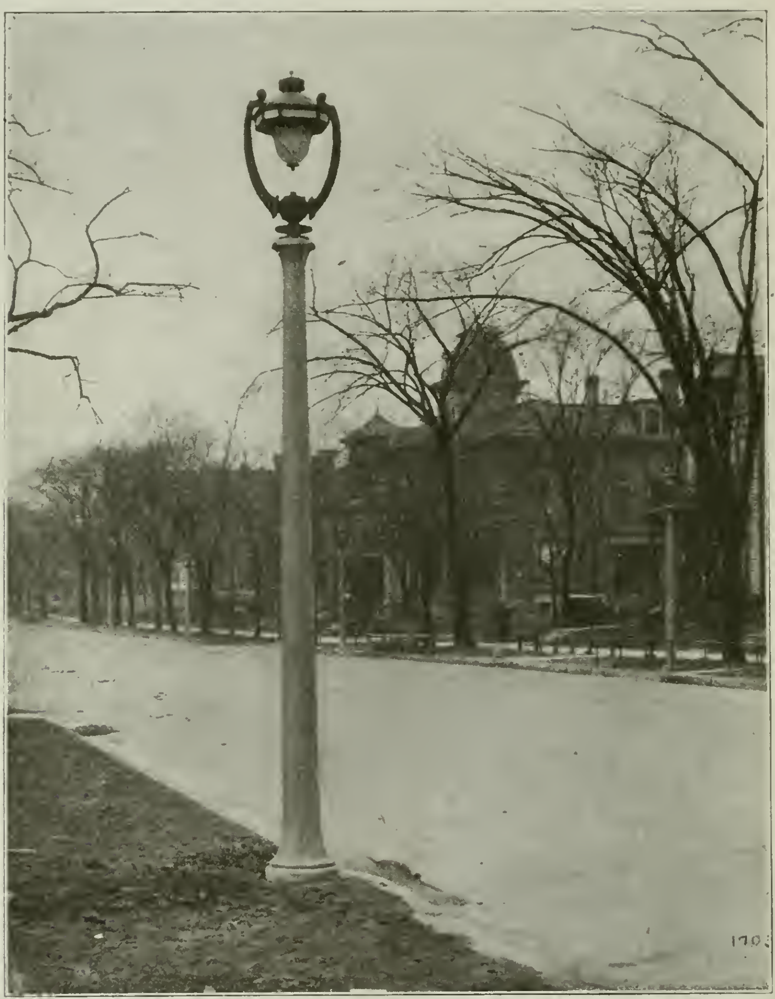


Figure 27. 15-ft. Concrete, Harp Type. Street Lighting Unit.

CLOSURE.

Presented by F. A. VAUGHN.

The system has been adopted for the entire city of Milwaukee, including at least 8,800 units, covering all sections of the city; and at the present time, outside of the demonstration circuit, which was installed first and which covers about forty blocks, it is between

40% and 50% installed, in various parts of the city, including about 1500 gas units. The gas installation could be done, with the minimum amount of digging, which was therefore started in the late fall of 1918 and was continued up until the heavy snows. These gas units are already completed. Eighty-four thousand dollars worth of installation work was first contracted for, for the installation of several circuits in the city. The plans of the entire system, which will take about $500,000 for the installation work alone, have been practically all contracted for, and the bond issue has been voted. The plans will go on in sequence. The government stopped

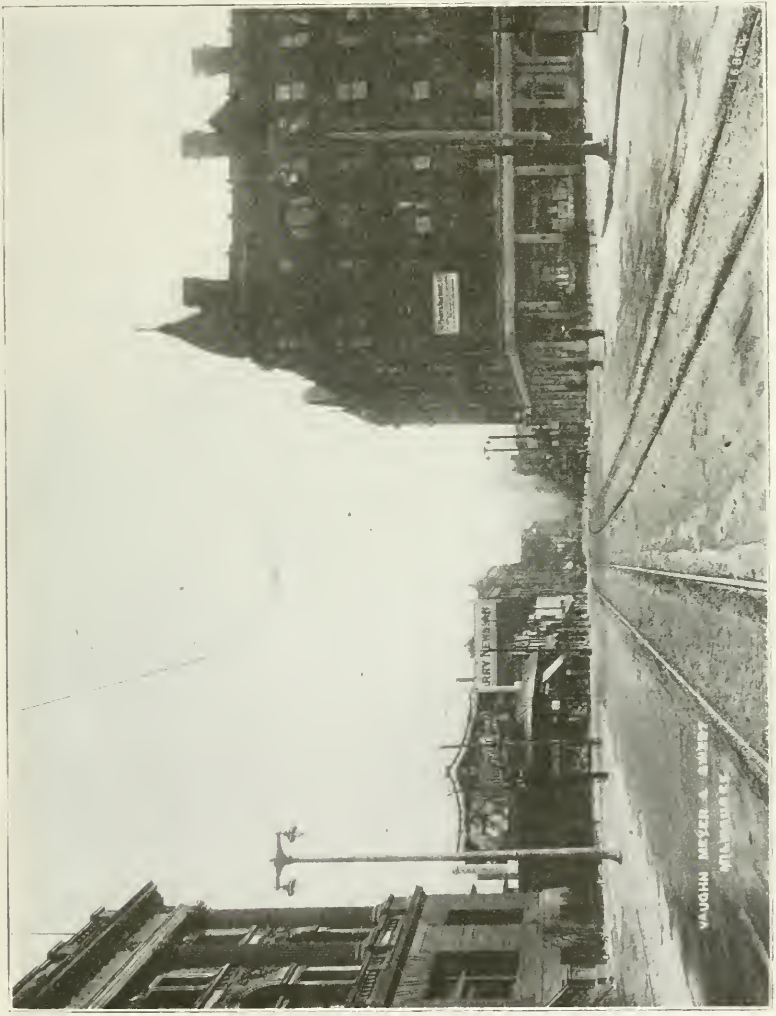


Figure 28. 30-ft. Double Bracket Unit—Eighth and Grand Avenue. New Street Lighting System, City of Milwaukee.

the work during the war, but great progress was made since the armistice. Large sections of the city and the principal streets are now lighted by the new system. The various contracts for material are already let, and practically the entire material list is contracted for and the greater part delivered, and in storage.

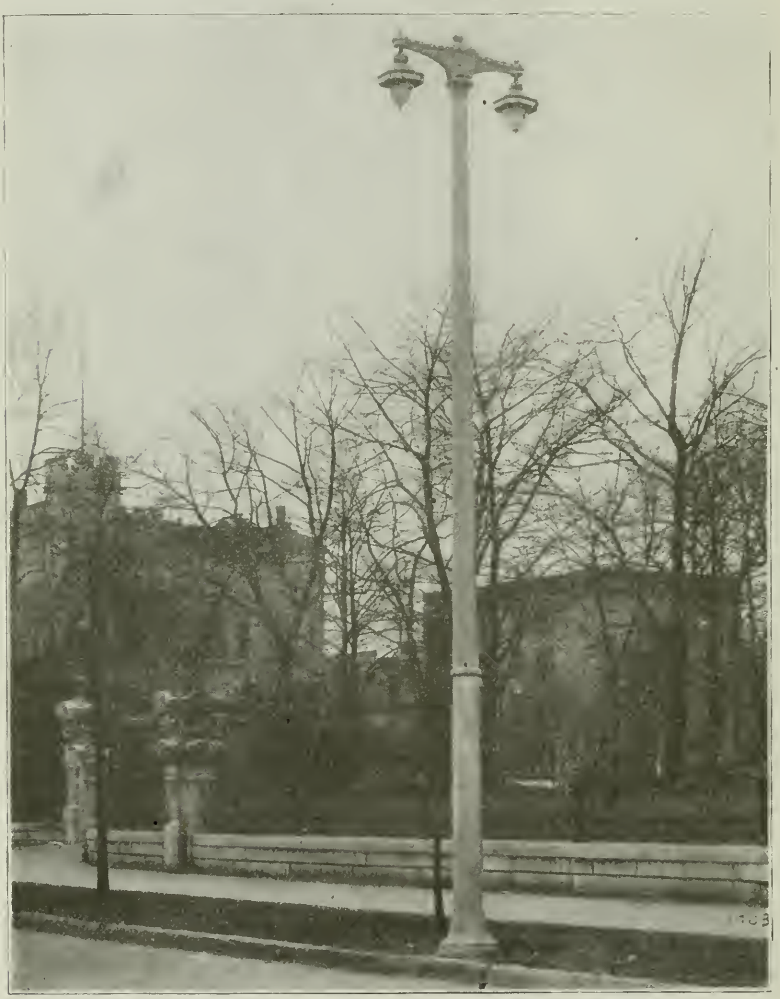


Figure 29. 30-ft. Concrete, Double Bracket Type, Street Lighting Unit.

The principal motive for the whole system was to so design it —with a full knowledge of the difficulties experienced in operating other types of systems for series-arc street lighting—that the difficulties to which these other systems fall heir would be largely eliminated. Perhaps I have had more "grief" than some others in operating the old types of transformers and systems. I have been called out of bed many times in the wee small hours of the night to correct troubles on them. The main idea, therefore, in the new system is to make it as simple, rugged and permanent as possible. This is the impelling motive. This is the reason for extra insulation, higher efficiency, close regulation and dependability in the new type transformers. This is the reason for the insulation of transformer cases against electrolytic currents. This is the reason for relatively heavy transformers, and this is the ideal of every effort and improvement connected with the new system.

July 20, 1920

The Santa Fe Apprentice System

By F. W. Thomas,
Supervisor of Apprentices, A. T. & S. F. R. R., Topeka, Kansas.

Presented May 3, 1920.

THE apprentice system on the Santa Fe Railway had its inception twenty-two years ago, through the hands of Mr. John Purcell, chief mechanical officer of the System, who was then master mechanic at Fort Madison, Iowa. Denied the privilege of a higher or technical education when a boy, and often in those days suffering from this handicap, and feeling the absolute necessity of mechanics in the shops having a working knowledge of mechanical and free-hand drawing, and being able to read blue prints intelligently, he determined that the young boys—the apprentices in his shop—should have a chance to learn and to know what had been denied him. From his own pocket he provided an instructor, furnished a room, drawing instruments, etc., free to the apprentices in his shop at Fort Madison. Years afterward, when the question arose of establishing a thorough and modern apprentice system on the Santa Fe system, he was just as eager to help. Immediately approving the scheme, he gave his wonderful organizing and character reading ability to establish the apprentice system on a firm and lasting foundation.

The twenty-six months of Federal control and operation of the railroads and the efforts of the Federal authorities towards unification of the roads, methods, and men, made many changes in our apprentice system, but as we propose to gradually work back to our former status and methods, I will take up in this paper much of the system as it stood prior to the war—which state we hope soon to regain.

History: During the late summer of 1907, when business was at flood tide, when we were sorely suffering for mechanics to man our shops, when we could not get them for love nor money, the management said, "If we cannot hire them, we will make them." A commission composed of our present mechanical head, Mr. John Purcell, then superintendent of shops, at Topeka, and myself, were appointed in August of that year, and sent out over the country to find out what schemes or systems were used by other railroads and manufacturers in training or educating their young mechanical help or apprentices. We made our report the last day of August, 1907, and with the characteristic promptness of the Santa Fe, the management ordered the establishment of our present apprentice system, at Topeka, by September 15th. There is one thing we have always done on the Santa Fe—we have obeyed orders. The "boss" may not say so when talking to me, but anyhow, I am still on the job. It was rather short notice, but we fitted up a room, made all necessary furniture, purchased such apparatus as we thought would be needed, and began business on time. We at once began to expand, and inaugurated the same scheme in our other shops, at the rate of one a month, for the succeeding twelve months. Our hands were at the plow, we never faltered, never turned back, but pressed onward and upward till this day. While some of the results that the Santa Fe has accomplished along this line may read like a romance, the facts are there.

School Instruction: I want to briefly outline our apprentice system for the training of mechanics for the various trades in our shop. There are two correlating and supplementary features. We have a room, preferably in a separate building, right in the midst of our shops, fitted up with desks, tables, lockers, blackboards, drawing boards, instruments, models for drawing lessons, etc. This is called our Apprentice School Room and is established and dedicated to educational work. It is the educational communal center of the whole shop and mechanical organization. It is a place where the mechanics, the foremen, officers and clerks can, and do, obtain any information or help upon any mechanical device or question. The apprentices assemble in classes at stated hours, in this room, twice each week, and are paid their regular rate. Here they are taught a number of subjects that will be of value to them in mastering their trades. We teach them mechanical and free hand drawing, sketching, practical shop arithmetic, problems in mechanics, some descriptive geometry, algebra, etc. They study a treatise on their trade, something about the materials with which they work, a little railroad business letter writing, and other essentials. Through the medium of charts, working models and reading matter, the different auxiliary devices are studied—injectors, lubricators, safety valves, superheaters, and air brakes. Each apprentice also familiarizes himself with the company rules and the federal rules pertaining to his trade. We do not waste his time teaching anything about automobiles, gunnery or projectiles, but we do teach subjects needed in his trade. The lessons in drawing, mathematics, treatise on trades, examination questions, etc., are all prepared by us and printed in our own print shop. They are representative of the Santa Fe standards and practices. These are of a loose leaf form and are changed whenever occasion arises. They are kept fresh and up to date.

Shop Instructors: In the shop we have a man known as the Shop Instructor, one for each department, or one for about every twenty-five boys. He is selected from the ranks, a man of character, skilled in his trade, patient in his teaching and capable of imparting his knowledge intelligently to the boys in his charge. He is responsible for the thorough instruction of the boy, and jointly responsible with the Apprentice School Instructor for the physical, hygienic and moral instruction or welfare of the apprentice. He is not responsible for the output of the shop, though he is responsible for the maximum effort of the boy. He sees that each boy gets a fair and equal opportunity, and he is particularly charged with responsibility for the careful training of the timid or backward boy. The Shop Instructor ranks along with the Department Foreman, and both report to the same shop officer. In the temporary absence of the foreman, the instructor takes his place. While much of this monitorial and parental watchfulness was abrogated by the Federal Government during its control of the railroads, we still exercise some of it and hope for the day of its complete resumption.

Apprentice Board: We have in our shops, a body known as the Apprentice Board. This board is composed of the General Foreman, department and gang foreman, the shop instructors and the school instructor. Each and every apprentice, either in person or in name, is brought before this board every six months during his entire apprenticeship of four years. All matters in reference to the talent or fitness of the boy, discipline, transfers, etc., are investigated and handled in a recommendatory manner to the ranking mechanical officer of that shop for his action and finally to the supervisor of apprentices. I do not know of any governing step that has been so fruitful of good results as this Apprentice Board. It makes each shop officer take an active knowing individual interest in the boy. He is called upon to pass judgment upon the boy, and he soon feels and knows he must find out all about the boy. This Board, like an honest court of last resort, is anxious to know all about the case and will not render a decision until the members are thoroughly satisfied with their opinion. It has also created an interest in the other shop employes by the foremen, a personal interest and desire upon the part of each foreman to treat all his men with that interest and feeling which begets loyalty and service.

Schedule Through Shops: At the larger shops affording ample facilities, a fixed schedule of work is outlined for each apprentice to pursue. This is so arranged that he completes the course in three years and six months, leaving six months for review or specializing. When he completes his apprenticeship, we give him the standard rate of pay, and before the advent of this seniority rule promulgated by the Director-General, we assigned him to a class of work for which he had shown himself best adapted.

Federal Approval: While the Federal Government, in its efforts at standardization and unification, took away much that was attractive, interesting, and beneficial, greatly lowering the morale and, I may say, the esprit de corps, it still left much of value and at the end, or near the end of Federal control, recognizing the value of Santa Fe methods, it ordered the establishment of similar schools for apprentices on all roads, or the co-operation of the railroads with the vocational training departments of the public schools.

College Men: The National Agreement, made by the Director-General with the shop crafts, makes no provision for special apprentices, that is, young college men, a very unfortunate omission. We had, before its abolishment by the Federal authorities, a well defined and productive course for these young college men, and a still shorter course for the brighter young men who had completed their apprenticeship. The object of this course was to select and develop material for positions of responsibility. The young college man was required to work one year on machines, one year on the floor or erecting shop, and the third year, known as "special course," was spent in car shop, boiler shop, roundhouse, with traveling engineer, and on inspection. With these went a course of reading and study, and the preparation of a thesis on the department in which he was working, and a monthly letter giving details of the work he had done and any constructive criticism he had to offer. This course produced ample material from which to select our supply of shop and staff officers. Not all, of course, made good, but as the course was so exacting and exhaustive, it gave us a very close likeness of the young man's calibre or makeup. Better have him fail in the preparation than to fail after being placed on the job.

Personal Interest: When an apprentice completes his apprenticeship, is graduated into a skilled mechanic, and is assigned to regular work, our responsibilities do not end there. He does not pass out of our interest. We continue a close watchful supervision over him. He may be transferred to an adjacent shop, or one a thousand miles away. If so, his name and personal file is sent by the local instructor to the instructor where this mechanic may be sent. These are often sent in advance. When he arrives at his new location, about the first person he meets is the local Apprentice Instructor. He will always be sure of one person who will give him a friendly welcome; one who will assist him in getting located, a place to live and board, show him where things are located in the shop, etc., and put him next to the ways and methods of the place. In other words, the instructor takes away the lonesome, disagreeable feeling we experience upon going to live in a strange town. If the graduate leaves the service, we still keep track of him, what he is doing, the pay he receives, the kind of people with whom he is working. We know where practically all of the young fellows who have left us are located. Following up the young man after he has been promoted to some position of trust, is one of our particular features. The first position is the most trying one of his life. Right here is where he needs a friend, counsel and advice from old heads. We are all prone when entering upon a new job, to make a record to turn things upside down, to tear down more than we can build up. He needs a balancing hand right now more than at any other time. He needs someone to hold him in check, to push him on at another time, to encourage him in his hour of despondency. One of our best master mechanics told me that when placing one of his graduates in charge of his roundhouse, he spent eight hours per day the first week, getting the young fellow started right. His reward was one of the best roundhouse men on the System.

Personal Interest of Officers: These details may be wearying, but I want to drive home the fact that we must take an interest in training the human hand and mind if we want them to become better and more proficient than the average. Let me recite a little incident which happened a few years ago. The author makes a monthly report reflecting the condition of affairs in our apprentice department. This report shows the number of apprentices in each trade at each point, number employed, number leaving the service, number graduated, number of graduates leaving and the reason for each individual case. The report for a certain month reported a graduate boilermaker leaving the service. Ordinarily the fact that one boilermaker leaves will not attract any particular attention in your business. I doubt if you would know it. He would no doubt receive his discharge check; his personal record would have written thereon, "Left service own accord; record, service and deportment, fair to good, etc." This young fellow was dissatisfied. The Assistant to Vice-President, our Chief Mechanical Officer, came out to Topeka a few days after he had read this report. He sent for me, wanting to know why this young boilermaker left. He was not satisfied with my explanation, so he sent for the Superintendent of Shops. He did not offer a satisfactory explanation. He then sent for the General Boiler Foreman, his assistant and the two instructors. There, for an hour, they stood on the carpet trying to explain why the young fellow was dissatisfied. The Assistant to Vice-President, busy as he was, and spending one-fourth of a working day trying to find out why this young boilermaker left the service, emphasizes the point I want you to see of the Santa Fe's method of training her men. He was not so much worked up over the cause, as he was that the cause existed and was allowed to exist. Where you see the high officers of any corporation exhibiting such an interest in the men in the ranks, individual interest, you will find a body of efficient and loyal men.

Ryerson Scholarships: Several years ago, I was advised that a Ryerson Master Mechanic Scholarship vacancy existed, and the appointment would be made in a few months. We looked over the list of available boys and told two to try for it. One of these won. Two years later another was awarded, upon a competitive examination, to a Santa Fe apprentice. We simply told several to go after it. The next year we had several ready and waiting for the competitive examination and a Santa Fe boy walked away with the prize. We have more getting ready for the next one and will win that one too, so long as a competitive examination rules the selection. This is a by-product of our apprenticeship. It is the result of knowing our boys. We are not standing still a moment, but are advancing daily, anticipating the future requirements. We are simply getting ready to meet the demand. We are looking for great returns from these young men who have served their apprenticeship and have received their practical education and are now acquiring their theoretical or college training.

Co-operation: What we have done, you can do. There is nothing complicated about it. It has required the entire time of its directing officer. It has required the full approval of our Chief Executive Officers, and it has had the full co-operation of all our employes, officers and men. The Apprentice System on the Santa Fe is as much a part of the mechanical organization as is the smith shop, the heating plant, or the power house. It has grown so fixed in its place, not only in our shops, but in the heart of shop officers, that it is a feature with them. It is not a cold blooded proposition. There is nothing cold blooded or cold calculating about it. It is full of warm blooded humane interest. It is no longer the style on the Santa Fe to fire a man because he may have slipped once. It is no longer permissible to discharge a man to cover up the failure of a supervising officer. We want these young men to feel safe and secure, so long as they do their part, and make an honest effort to give a day's work for a day's pay. Our present apprentice system has been in vogue thirteen years. From 345 boys in 1907, the number has grown to 1,303 today. Starting out with machinist apprentices, we are now giving instruction to boys in nine trades.

Results: Our apprentice system, the past ten years, has furnished the road with all of its shop officers. It has not been necessary to go outside for a foreman or master mechanic. It has provided all the draftsmen for our drawing rooms and men for staff duties. We have young men educated and trained, waiting for any emergency or any job that may turn up.

Graduates: On May 1, 1920, we had graduated 1,400 skilled mechanics. Of this number, 60 per cent, or 840, are in service today. Two hundred have been promoted to some position of responsibility. Topeka Shops, the largest shop on the System, had not, in 1917, employed a skilled mechanic from the outside for over two and a half years. Is it not some comfort to the Master Mechanic or Superintendent of Shops, in knowing when going about his other duties or when going to bed at night, that he has not upon his mind the worry as to whether he will have enough men when the whistle blows on tomorrow's morn to man his shops? Nor does he have to worry about his supervising forces. There are men trained and waiting for the job. In habits and character, these mechanics are of the best. Their homes are there, their friends and companions are there. They are more than shop men; they are good citizens.

The advantages gained from our apprentice system may be summed up briefly:

1. Ample supply of skilled mechanics for our shops, mechanics who are thoroughly skilled in our ways and methods.
2. Stabilizing employment. The recruits being at home and at work under favorable conditions, do not care much about roaming about.
3. Material from which shop officers and a mechanical staff may be recruited, young men with whom we are thoroughly acquainted and who have been especially trained and tried out.

July 20, 1920

Conclusion: We have not accomplished this in a day. Yet the growth in numbers, in quality of men, and in instruction has grown so gradually that we do not realize what we really have accomplished. To you the way is clear and easy, for you have the way blazed; the errors and failures of others are open to you. It will require some organization, some thought, some money and a lot of care and patience. You will always have problems of engineering, of locomotive construction and maintenance, of car designs, of shop tools and machinery. The greatest problem for you today—tomorrow, will be the training of the human hand, mind, and heart, to utilize to the limit, the instruments you place in their hands.

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Less ancient than the Sun, which gilds its hoary crest,
Old Cheops stands in majesty sublime,
And there has stood thro' centuries of rest
Uncounted in the numbered years of time.
There builded, in the memory of the World,
Between the desert and the fruitful Nile,
When ancient Egypt's flag—long furled,
Waved from the summit of the monster pile,
Who builded it? Those hands so long but dust,
The mind that planned and ruled the task,
The keen edged tools, absorbed by rust?
The answer comes not, whosoe'er we ask.
Later in time—before our Christ had birth,
The Science which informed the men of old
Found voice and teacher in the halls of Earth:
And still we're guided by the laws old Euclid told.
The squared hypothenuse its equal finds
In sum of squares upon right angled sides:
And geometric truth to human minds
Is sure and steadfast, whatever else besides,
And now to modern practice we assign
A worthy place upon our azure field
And make the transit, of unique design
The Emblem of our craft upon the shield.
All these surround three letters intertwined,
Making our badge of brotherhood complete;
Men who have mighty works designed,
Men who with the Titans dare compete.

—*Isham Randolph*

CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV AUGUST 20, 1920 Number 12

Organizing Conference Adopts Constitution for Federation of Engineering Societies

CONSTITUTION OF A NATIONAL ENGINEERING ORGANIZATION.

ART. I.—NAME.

The name of this organization shall be The Federated American Engineering Societies.

ART. II.—OBJECT.

Service to others is the expression of the highest motive to which men can respond, and duty to contribute to the public welfare demands the best efforts that men can put forth. Therefore, it shall be the object of this organization to further the interests of the public through the use of technical knowledge and engineering experience, and to consider and act upon manners common to the engineering and allied technical professions.

ART. III.—MEMBERSHIP.

Sec. 1. Scope. The membership shall consist of national, local, state and regional engineering and allied technical organizations and affiliations, classified as follows:

(1) National engineering and allied technical organizations.

(2) Local, state and regional engineering and allied technical organizations other than local associations, sections, branches or chapters of national organizations.

(3) Affiliations consisting of any one, or a combination, of the following constituents:

(a) Local sections and associations of members of national organizations included under (1).

(b) Local engineering and allied technical societies and clubs, not of national scope.

(c) Local engineers and members of allied technical professions and their associates.

Sec. 2. Qualifications. The qualifications for membership shall be as provided in the By-Laws.

Sec. 3. Application for Membership. Application for membership shall be made in the form and manner prescribed in the By-Laws.

Sec. 4. Termination of Membership. The membership of any constituent organization may be terminated by it or by the Council in the manner provided in the By-Laws.

ART. IV.—MANAGEMENT, AMERICAN ENGINEERING COUNCIL.

Sec. 1. The management of this organization shall be vested in a body to be known as the "American Engineering Council," and its Executive Board.

Sec. 2. Functions. The American Engineering Council shall consist of representatives of Member Societies selected as hereinafter provided. This council shall co-ordinate the activities of state councils and of local affiliations, whenever these activities are of national or general importance or may affect the general interests of engineers.

Sec. 3. Representation. Each national, local, state or regional organization, or affiliation, shall be entitled to one representative on the Council for a membership of from 100 to 1,000, inclusive, and one additional representative for every additional 1,000 members or major fraction thereof; provided that in the determination of the representation of local, state or regional organizations or affiliations no count shall be taken of any organization which is represented individually or through another local, state or regional organization or affiliation; and, provided further, that no organization shall have more than 20 representatives on the Council.

Sec. 4. Selection of Representatives. Representatives on the Council shall be selected as stipulated in the By-Laws.

Sec. 5. Meetings. The Council shall hold an annual meeting. Other meetings may be called by the Executive Board and shall be called by it upon the written request of 25 representatives on the Council.

Sec. 6. Officers. The elected officers of the Council shall consist of a President, to hold office for two years, and who shall be ineligible to re-election; four Vice-Presidents, to hold office for two years, two to be elected every year, and a Treasurer, to hold office for one year. These officers shall be elected by a letter ballot of the Representatives on the Council as provided in the By-Laws. There shall be an Executive Officer who shall also be Secretary appointed by and holding office during the pleasure of the Executive Board. He shall not be a member of the Executive Board but may be a representative on the Council.

EXECUTIVE BOARD.

Sec. 7. Functions. There shall be an Executive Board of 30 members of the Council constituted as hereinafter provided and charged with conducting the business of the organization under the direction of the Council.

Sec. 8. Membership. The Executive Board shall consist of 30 members, of whom 6 shall be the officers elected by the Council and 24 shall be selected, a part by the national societies and the remainder by the local, state or regional organizations or affiliations according to districts, as provided in the By-Laws; provided, that the number of representatives of the national societies on the Executive Board shall bear as nearly as may be the same ratio to the number of representatives of local, state and regional organizations or affiliations as the number of representatives of the national societies bears to the number of representatives of the local, state and regional organizations on the Council.

Sec. 9. Electoral Districts. For the purpose of facilitating the selection of the district members on the Executive Board, the Council shall divide the country into districts as provided in the By-Laws, based upon an equitable representation, having regard to both its membership and area.

Sec. 10. Officers. The President

(*Continued on page* 25)

Board of Direction

Appications for Membership. The following applications for membership in the society were presented to the Board of Direction at its meeting held August 9, 1920:

D. C. Jones, Chicago, Ill.
E. P. Shnable, Wilmette, Ill.
Lorenzo Dana Cornish, Chicago, Ill.
F. A. Nelson, Newark, N. J.
Milton T. Cole, Chicago, Ill.

The Federated American Engineering Society. The Western Society of Engineers has been requested to approve the constitution and by-laws adopted at the conference held at Washington last June, and to accept memberships in this society as well as appoint delegates to the initial meeting to be held early in the fall. The Board of Direction has appointed a special committee to consider this matter and report to the board with recommendations. This committee is to consist of C. F. Loweth, Chairman; A. L. Rice, A. F. Riggs, George M. Davidson, H. R. Safford.

American Society Port Authorities. The annual convention of this society will be held in Chicago, September 30, October 1 and 2, 1920. The Western Society of Engineers has been requested to co-operate in this meeting and has provided a number of speakers who will discuss Chicago as a port. Further announcement of this board meeting will be given to the membership.

The Board of Direction has appointed a special committee to draw up suitable resolutions and a memorial to Mr. Isham Randolph, who died August 2, 1920. This committee consists of Messrs. A. S. Baldwin, A. V. Howell, Onward Bates.

Member of W. S. E. with Industrial Management Department of the La Salle Extension University

In the July number of the Personal Efficiency Magazine, issued by the above mentioned university, a very interesting article on Chas. F. Scribner, M. W. S. E., was presented.

Mr. Isham Randolph

Mr. Isham Randolph died August 2, 1920. This brief statement has brought sorrow and bereavement to his many friends. One could not be content to record the passing of this good man with a recital of his birth, parentage, education, achievement in his profession, and society membership alone, without considering among them all, the heart and brain which were conspicuous in his career, and the effect that his life has had on his contemporaries.

Mr. Randolph came from Virginia. Fifty years later his body has been returned to his native valley. These fifty years have witnessed the greatest achievements in the world's history. His profession has been developed during this period and in this development he had a conspicuous part. To him came the conception of great ideas and accomplished tasks. This is a heritage of every engineer who measures up to his opportunities. To pass through life with no creative thought can only be a disappointment.

In addition to the achievements in his profession, Mr. Randolph was known for his quality of friendliness. Again one reads David Grayson's Adventures in Friendship and feels that he has seen and known a living epistle in friendship. The ideals and accomplishments of Mr. Randolph will be an inspiration to us all.

Personal

Mr. W. H. Bentley, Assistant to the Secretary of the Western Society of Engineers, is in Wisconsin on his vacation.

Harry J. Bell, formerly supervisor of safety for the Northwestern region of the United States Railroad Administration, has been appointed secretary of the Chicago local of the National Safety Council and the Chicago Association of Commerce.

Announcement

Examination for structural engineers for the State of Illinois will be held Oct. 11-12-13 at Room 1006, City Hall, Chicago.

New Members

At the meeting of the Board of Direction held June 28th, 1920, the following new members were elected:

No.	Name.	Address.	Grade.
81	Strickler, John	R. 729, 208 S. LaSalle St.	Member
84	Heitzman, Ralph H.	2418 Jackson Blvd.	Student
87	Gaensslen, Carl A. Transfer from Associate.	655 Roscoe St.	Member
88	Dunford, S. H.	R. 746, First Natl. Bank Bldg.	Member
90	Cory, Charles Russell	4040 Kenmore Ave.	Junior
93	Weitmann, Waldemar E.	425 First Ave., Milwaukee, Wis.	Student
94	Koyl, Herschel Charles	c|o C., M. & St. P. Ry., Rail. Ex.	Member
95	Farrier, Clarence W.	5700 S. Peoria St.	Assoc.
96	Fisher, Harold P. Transfer from Associate.	64 W. Randolph St.	Member
97	Baer, Fred L.	c|o Automatic Electric Co., 1001 W. Van Buren St.	Member
100	Kellam, Fred	1112 Central Ave., Apt. O., Indianapolis, Ind.	Assoc.
102	Mackey, Walter Curriden	124 Second St., Waukegan, Ill.	Junior
1168	Shaw, F. K. W.	6283 Louise Ave.	Assoc.
1282	Grambauer, A. F.	7012 Stony Island Ave.	Assoc.
82	Hartzell, Samuel A.	25 S. Des Plaines St.	Member
83	Goodwin, L. Reeves	327 S. LaSalle St.	Member
85	Malatesta, Stephen	355 Old Colony Bldg.	Member
86	Larkin, Wm. James, Jr.	1102 Webster Bldg.	Assoc.
91	Fieberts, Harry W.	5620 S. Bishop St.	Assoc.
92	Emmett, Richard, Jr.	25 S. Des Plaines St.	Member
98	MacDuffee, K. M. Transfer.	4212 Hichman Ave., Des Moines, Iowa.	Assoc.
99	Wertheim, F. E.	1508 N. Larrabee St.	Member
100	Edwards, Stanley R.	116 S. Michigan Ave.	Member
101	Page, Charles B.	431 S. Dearborn St.	Member
103	Derr, W. L.	Grand Central Station, Chicago.	Member
104	Windt, William de	1309 Morse Ave.	Assoc.
105	Sherwood, Ludlow S.	52d Ave. and 2d St., Cicero, Ill.	Member
814	Sawyer, R. C.	Gladstone Hotel, Chicago, Ill.	Member
1142	Berge, Olav	American Bridge Co., Gary, Ind.	Member
1647	Dean, John S.	1716 W. 100th Place.	Member
89	Ballard, Samuel R.	R. 5, Union Depot, Burlington, Iowa.	Member

And at the meeting held July 12th, 1920, eight more were added:

106	Jones, Samuel E.	c|o Sears, Roebuck & Co., Construction Dept.	Assoc.
107	Gring. Wilbur D.	"The Maples," Newport, Perry County, Pennsylvania.	Assoc.
108	Erickson, Carl W.	5241 Glenwood Ave.	Junior
109	Counselman, T. B.	Babbitt, via Mesaba, Minn.	Member
110	Fletcher, Claude Anthony	7005 Vernon Ave.	Junior
111	Hayes, John J.	1932 Darrow Ave., Evanston, Ill.	Student

Maj. Robt. Isham Randolph for Sanitary District Trustee

"Sanitation is an engineering task, not a political job. I am an engineer, not a politician."

Engineers will be interested to know that Maj. Robert Isham Randolph, M. W. S. E., has announced his candidacy for nomination on the republican ticket as Trustee of the Sanitary District of Chicago.

Robert Isham Randolph is a graduate of Cornell, and was employed by the Sanitary District from 1904 to 1907. He has been secretary of the Internal Improvement Commission of

Illinois and of the Rivers & Lakes Commission of Illinois. He enlisted as a private in battery C of the 1st Illinois field artillery and went to the Mexican border in 1916 as such and was mustered out as instrument sergeant of the battery, joined the first officers' training camp at Fort Sheridan and was commissioned as captain of engineers, assigned to duty at Fort Leavenworth and later to Camp Lee as major. As a major he organized the 535th engineers at Camp Lee, took the regiment to France and served in the San Mihiel sector with the second army, A. E. F.

Maj. Randolph is the son of the late Isham Randolph, who was chief engineer of the Sanitary District when the drainage canal was built and who afterwards for many years was consulting engineer for the District. Robert I. Randolph is well known in the engineering profession where he has shown marked ability and made a large number of friends. He has announced as his slogan "An engineer for an engineering job."

Hardwood Shortage

After many weeks spent in the southern lumber territory a special investigator for the National Council of Furniture Associations has reported to the council, so states a document issued by that Association, that the hardwood lumber shortage was due to such adverse weather conditions that the mills could not be operated. He declared that he was satisfied that the manufacturers had done their utmost to increase the output but that they had met insurmountable obstacles. The sawmills, this investigator says, have found it impossible to follow their usual custom of storing logs and the result has been to use up almost their entire reserve stock with no immediate chance of replenishing it from the flooded forests.

August 20, 1920

Sears, Roebuck & Co. Luncheon and Inspection, August 27th

Members and their guests will meet at 1:30 p. m. at the entrance of the Administration Building of Sears, Roebuck & Co., located on Arthington Street, between Homan and Spaulding Streets. Luncheon will be served promptly at 2.

You can get there either on the Garfield Park branch of the Metropolitan elevated to Kedzie Avenue station and walk three blocks south to Arthington Street, then one and a half blocks west to the Administration Building; or take the Kedzie Avenue street car to Arthington Street and walk one and a half blocks west.

Arrangements have been made for the parking of automobiles for the convenience of those desiring to drive.

Don't forget to mail the return postal card promptly. You will get this in a day or so.

Coal Situation Easier

Official Report Says More Coal Mined and Moved

Production and transportation of coal is somewhat increased, according to the Geological Survey Report made public recently.

Despite a decrease in production of 1,523,000 tons as compared with the previous week, due to the strikes of mine laborers in Illinois and Indiana, the end of July found bituminous production since the beginning of the year to have reached 302,727,000 tons, an increase of 44,500,000 tons over the amount mined up to July 31 last year.

Anthracite production also compares favorably with 1919, having reached 50,570,000 tons on July 31, as compared with 47,307,000 tons at the end of July of 1919.

The Illinois and Indiana strikes caused production of bituminous coal to go below level, but now show improvement.

DEVELOPMENT COMMITTEE

E. T. HOWSON, Chairman

Although reappointed only recently, the development committee has undertaken the investigation of several activities looking toward the extension of the work of the society. Among these is the study of the technical meetings, with a view to securing increased attendance.

Among the suggestions to this end which are under consideration are the strengthening of the character of programs presented, the reduction in number of meetings, more extended combination of sections in joint meetings, etc., etc.

The committee has also a questionnaire in preparation which it is expected will be sent to the membership early in the fall, to secure their views regarding a number of present and proposed activities of the society.

ENTERTAINMENT COMMITTEE

A. B. BENEDICT, Chairman

When the social activities are resumed in the fall we hope to make the winter of 1920 and 1921 the most successful and enjoyable winter in the history of the society.

I know this sounds like a large order, and it is, but our present plans point to its fulfillment. One has to aim high in order to get real results.

MILITARY COMMITTEE

MURRAY BLANCHARD, Chairman

I have to say that the military committee has prepared a questionnaire, which will soon be mailed to the entire membership of the society. Last year requests for the military and civilian records of service in the World's War were issued before the membership drive, and we hope to obtain the records of the new members and an expression from every one on the subject of universal military training.

The committee has co-operated with the State Publications Society in their effort to obtain the records of all of the Illinois engineers who were in the service, and would appreciate notice from anyone who was in the service and has not received a questionnaire. Over 1,000 have responded, but there are undoubtedly many whose addresses we do not have and whose names do not appear on the roster of any engineering society, whom we would be glad to include.

PROGRAM COMMITTEE

G. A. HAGGANDER, Chairman

On June 29 this committee held a meeting to consider possible changes in the conduct of our technical meetings, as well as the subjects for next year's program.

I have taken up with each of the section chairmen the matter of calling a meeting of their executive committee, so that they can furnish the program committee a list of subjects and speakers from which we can complete our schedule. I have asked them for subjects of their own section, subjects for joint meetings of two or more sections, and also for general meetings.

Another meeting of this committee was held on July 27, and some real definite work was done on the program for the first part of the year.

This committee will welcome suggestions from members, names of subjects on which they can speak or which they would like to hear papers on. with names suggesting probable speakers.

STUDENT BRANCH COMMITTEE

A. D. BAILEY, Chairman

This committee has done practically nothing so far, as it is a poor time to start anything along this line during the closing of the school year. This work logically starts in the fall, and it is our plan to push it very vigorously when the universities open in September.

TERMINAL RAIL *and* WATER COMMITTEE

J. R. BIBBINS, Chairman

Terminal Committee Arranging for October Convention of American Association of Port Authorities

At a recent meeting the newly organized terminal committee made a tentative statement through its Chairman, Mr. J. Rowland Bibbins, on its contemplated activities, reported in another issue. The most important preliminary work falling to this committee has been the preparation for the fall convention of the American Association of Port Authorities, meeting here in October. This association is the strongest national body interested in the field of port development. It comprises in its membership roster men of experience and ability, not only in administration, but also in engineering design, including also some of the membership of the Society of Terminal Engineers.

It has been the effort of the terminal committee to secure close cooperation between the port authorities, terminal engineers and Western Society of Engineers with the specific object of having the problems of the Great Lakes ports and Chicago discussed before this convention. The tentative program of the convention includes addresses. List of tentative speakers was published in the Journal W. S. E. in the issue of July 20, 1920.

The last named address was secured through the agency of the terminal committee and there will be two or three additional addresses announced later, with respect to the problems of the watergate of Chicago and its relation to water transportation on the Mississippi, the Great Lakes and overseas, dealing especially with the fundemental economics of the transport situation.

A glance at this program will suffice to indicate to the engineers of the Middle West that it is high time Chicago's development received more thorough and intensive study.

Through the agency of the terminals committee the Western Society of Engineers and the Society of Terminal Engineers have been officially invited to take part in this meeting of the port authorities which will be the most important one ever held by this association, especially as it occurs at a time when the investigations of the international commission on the St. Lawrence waterway are under way.

The Port Authorities Association has met in many other cities, and it is the duty of the Chicago engineers concerned in the broad development of the district to interest themselves in this forthcoming convention.

The consolidated Index and Contents for Volume XXIV, 1919, of the *journal* are now ready for distribution.

These are complete—from January to November, inclusive. There will not be a December, 1919, number issued.

Any one desiring a copy of the Index and Contents may have same by applying to Editor.

PUBLIC AFFAIRS COMMITTEE

ANDREW ALLEN, Chairman

The urban transportation committee present the following brief progress report of recent proceedings of public interest relative to increased rates for service rendered by transportation utilities:

General. There is now in controversy between the various companies who own and operate the public utilities in the City of Chicago, and the city authorities, who represent the public, the settlement of increased rates which the public is asked by the companies to bear to enable them to meet their operating expenses, fixed charges and to pay a fair rate of return on their capital investment.

Under the statutes of the State of Illinois the decision as to the reasonableness of rates rests with the Public Utilities Commission and has so been upheld by the Illinois Supreme Court, which has rather clearly outlined the basic matters to be considered by the commission in their determination of rates.

At present there are under investigation by the Public Utilities Commission the requests of the following local utilities for permanent increase in rates:

Chicago Surface Lines.
Chicago Telephone Company.
Chicago Elevated Railways.
Peoples Gas, Light & Coke Company.

A temporary increase in rates to the surface lines, telephone company and gas company has recently been granted. We do not feel it to be within the province of our committee to report or pass on the justice of the amount of increased rates without an exhaustive and thorough investigation which would require the undivided time and study of a large body of experts for a considerable period. Suffice it to say this committee believes the members of the Public Utilities Commission to be capable of rendering an unbiased decision on the merits of the cases involved, and that their conclusions will be based on the evidence presented.

The companies and the city have found it necessary to go to great expense to prepare and present their cases before the Public Utilities Commission. The city has spent nearly a year in pleading their contentions before the commission and in the courts attacking on every point the claims for increase in rates on the part of the Chicago Surface Lines, and the Chicago Elevated Railways. In this connection it should be remembered the expense incident to all these reports, trials and controversies is in the end borne by the public.

The following table shows the funds so far appropriated by the city to carry on the fight against the surface lines and the elevated for increase in rates although it is the contention of the corporation counsel that to complete the work additional funds will be necessary:

	Appropriation Up to June 30, 1920
Chicago Surface Lines......	$361,302
Chicago Elevated Railways..	281,800

Your sub-committee is keeping in close touch with the situation and will report from time to time. At present all of the proceedings with their many ramifications relating to rates are being thoroughly investigated by the Public Utilities Commission which under the statutes is the tribunal upon which rests the decision as to fairness of rates subject to review by the courts. As before stated, we believe its final decision will be predicated on facts as determined by the evidence and pending a final decision we will conclude this report with a few historical remarks on the case of the Chicago Surface Lines, as in this case the presentation of evidence has been completed. At a later date a historical digest of the cases of the other utilities will be presented as well as a comprehensive report regarding the mayor's public ownership plan of the surface lines now about to be presented to the City Council for action to secure enabling legislation from the State Legislature.

CHICAGO SURFACE LINES

Comprising

CHICAGO RAILWAYS COMPANY
CHICAGO CITY RAILWAY COMPANY
CALUMET & SOUTH CHICAGO RAILWAY COMPANY
THE SOUTHERN STREET RAILWAY COMPANY

Historical. Prior to 1907 there existed in the City of Chicago a number of street railway companies operating antiquated traction lines and equipment, rendering inefficient service to their patrons, due no doubt in part to the prospective early termination of some of their franchises with no assurance of their renewal. Plans, reports and litigation regarding service, franchises and municipal ownership were constantly being presented to the public. In 1906 a traction valuation commission was appointed to make a valuation of the properties of the companies, and based upon their valuation reports the so-called settlement ordinances of 1907 and 1908 were entered into. Under the terms of these settlement ordinances the companies were allowed the following amounts as representing the fair value of their properties:

Chicago Railways Co.....	$28,000,000
Chicago City Railway Co..	21,000,000
Calumet & South Chicago Railway Co............	5,000,000
The Southern Street Railway Co...............	775,000
	$55,775,000

Subsequently the Chicago Consolidated Traction Company was taken over by the Chicago Railways Company at a value of about $4,000,000 and the Chicago & Southern Traction Company was taken over by the Chicago City Railway Company at a value of $600,000, all values having been predicated upon a detailed valuation prepared by the Traction Valuation Commission.

Included in the above $55,775,000 were certain intangible values in the aggregate amount of about $10,000,000, the difference of about $45,775,000 representing the then depreciated value of the physical property.

These settlement ordinances contained provisions regarding additions to capital, renewal expenditures and appropriations, etc., and also made it mandatory for the companies to immediately proceed to rehabilitate and extend a specific portion of the lines and to provide additional equipment, all expenditures therefore (for a period of three years) to be charged to capital account.

During this three year period of immediate rehabilitation under the requirements of the settlement ordinances approximately $14,800,000 in serviceable property was discarded and replaced by property of up-to-date design and construction, which placed the properties in a modern state of efficiency.

Many other interesting phases could be referred to but the object herein is to bring forth the fact that some $25,000,000 of intangible or going concern value now rightfully exists in the capital account of the companies.

Since the date of the settlement ordinances the additions to the system of the traction companies have necessitated an expenditure of about $105,000,000 which has been made under the direction and with the approval of the Board of Supervising Engineers, so that the companies' capital investment as of January 3, 1920, was about $159,000,000.

The companies contend they should be allowed to charge a rate of fare which would provide their necessary operating expenses as well as a fair rate of return on their capital investment.

The city contends the settlement ordinances provide for a five cent rate of fare and any other rate would be a violation of the contract ordinance. Furthermore, it insists the companies could under a five cent rate earn sufficient to pay operating expenses, and a fair return on the capital investment, if the intangible values were eliminated.

The companies under their contract with the city claim a capital value of $159,000,000 and have issued new securities nearly to the amount of their additions to capital account. They desire to protect the interests of those who have invested in these securities. They have been confronted with increased costs of labor, material and equipment in every department, and contend that it is impossible to operate on a five cent fare. During 1918 the National War Labor Board increased the wages of the employees without regard to the manner in which the funds for increased wages should be provided. During the summer of 1919 a strike was inaugurated by the employees for increased wages and upon urgent pleadings of the companies before the Public Utilities Commission the rate of fare was at the time increased to seven cents to meet this increased wage scale. It remained at this figure from August 1, 1919, to November 28, 1919, when it was reduced to six cents through the purchase of tickets, and on December 27, 1919, a straight six cent fare was ordered by the commission. In a recent order the commission allowed a temporary increase in fares to eight cents effective as of July 1, 1920. We may expect the fares to remain at eight cents until such time as the commission has digested the mass of testimony presented by both the company and the city and has reached a conclusion on a rate fair and equitable, both to the companies and to the public.

The companies for the past four years have been unable to procure funds to purchase equipment although it is urgently needed.

The reason for the inability of the companies to procure funds to purchase equipment has been presented to the commission by many of the leading financial men of the city and is all to the effect that funds cannot be provided without some assurance that the integrity of the companies investment will be protected.

As before stated, this committee is as closely in touch with this important matter as time will permit and will now proceed to set forth some of the claims on the part of the companies and the city on the fair value of their properties on which the rate of fare should be based to provide an adequate return on the capital investment and pay operating expenses.

Valuation of the Property of the Chicago Surface Lines. During the early part of 1919 the Chicago Surface Lines employed the services of two engineering firms of national reputation to prepare an inventory and valuation of the properties. A complete and detailed inventory as of January 31, 1919, was prepared and a cost of reproduction reported, which represented the cost which would be incurred in reproducing in a new condition the property owned as of January 31, 1919, under the same conditions as existed at the time such property was constructed.

All prices of material, apparatus and equipment used in the appraisal were the prices prevailing on or about April 1, 1919, as quoted by manufacturers and dealers, these prices being based on the government prices promulgated during the latter part of March, 1919, which were lower than the current prices.

The cost of labor was based on labor wage scales in effect in Chicago during April, 1919. Upon this basis the reproduction cost of the property of the Chicago Surface Lines as of January 31, 1919, was found to be $200,371,689.

During the latter part of 1919 the city engaged a firm of reputable engineers to check the appraisal which had been prepared for the companies and to analyze and report on any difference or discrepancies which might be found. This firm had access to all data which had been compiled by the engineers of the companies relating to the inventory and valuation but they worked wholly independently and without consultation with the engineers of the company, so that a comparison of the conclusions reached on the cost of reproduction of the property by these independent and separate investigations is interesting.

Briefly summarized they are as follows:

	Cost of Reproduction.
Engineers for the company	$200,371,689
Engineers for the city	186,335,895
Amount of difference	$ 14,035,994
Percent of difference	7

A large part of this difference is accounted for in the different premise adopted by the two engineering firms and is now the result of a difference of opinion in the inventory quantities or the application of price to the inventory units.

The city, however, claimed there should be deducted from their cost of reproduction about $8,000,000 for property not used in the operation of the system. To this the companies replied that most of this property was formerly used for railroad purposes, was a part of the capital account created by the settlement ordinances, that all rents or other income derived therefrom are credited to income account, that under the settlement ordinances none of this property can be sold by the companies except upon the written approval of the Board of Supervising Engineers and when thus sold the proceeds must be deposited as part of the special fund created by the ordinances for renewals and depreciation. The companies contention is that property thus specifically set aside for renewals and depreciation is devoted to the public use and that inasmuch as the income therefrom is included in the income account of the companies, the fair value thereof must be included in arriving at the amount upon which they are entitled to a fair return.

The engineers of the city also presented to the commission an approximate cost of reproduction of the property based on applying to the inventory units average unit prices from 1915 to 1919, inclusive.

The engineers for the company also prepared in considerable detail and presented to the commission a cost of reproduction of the property based on unit prices prevailing during different periods.

A comparison of these costs of reproduction of the property as of different dates exclusive of intangible value is as follows:

Based on Unit prices:	Engineers for the city	Engineers for the company
As of April 1st, 1919	$188,336,000.00	$200,371,000 00
As of April 1st, 1920		247,247,000.00
Average for 6-year period, 1914 to 1919	157,694,000.00	164,812,000.00
Average for 7-year period, 1914 to 1920		176,588,415.00

The intangible values in the amount of about $25,000,000 herein before referred to are not included in the above costs of reproduction, nevertheless any one of the above valuations would apparently support the contentions of the companies that they are entitled to earn a fair rate of return on their book account of about $159,000,000 which is the price at which the city may acquire the properties under the terms of the settlement ordinances.

An estimate of the amount of depreciation was also prepared by the engineers of the city and the engineers of the company and presented to the commission. There was considerable difference of opinion between the engineers in the amount of depreciation so reported, the engineers for the city estimating the total depreciation, exclusive of land, to be 25.78 per cent of the cost of reproduction, while the engineers of the company estimated the total depreciation, exclusive of land, to be 18.57 per cent of the cost of reproduction. A large part of the difference in depreciation as reported by the both firms of engineers was due to their conclusions as to the life of track. We will not make any further references to depreciation except to say that the companies contend they have an adequate renewal fund to provide for renewals as and when required, this fund now having accumulated to about $10,000,000.

In conclusion and briefly summarized the surface line companies contentions are as follows:

1. The rate of fare as established by the commission should be sufficient to provide the necessary operating expenses and produce an adequate rate of return on the capital investment.

2. They desire an adequate rate of return on their capital account of about $159,000,000 so as to protect the integrity of their investment.

3. It is clearly demonstrated the cost of reproduction of the property by different methods of computation is in excess of their capital account.

4. They desire to firmly and conclusively re-establish their credit so funds may be secured for necessary additions and extensions.

The City contentions are as follows:

1. The contract or settlement ordinances of 1907 and 1908 provided for a five cent fare and these contracts are valid and binding and no provision of the contracts can be changed without abrogating them in their entirety.

2. The companies should be required to provide adequate equipment and service.

3. Increased rates if allowed will give a larger return and would not result in any increased facilities.

4. The valuation contended for by the companies is excessive.

We are presenting this report to the public affairs committee without any explicit recommendations. We, however, direct the committee's attention to a statement in regard to furnishing relief to public utilities recently presented to the Public Utilities Commission by the following associations and clubs of the City of Chicago:

Chicago Association of Commerce.
Chicago Association of Credit Men.
Citizens' Association of Chicago.
Chicago Commercial Club.
Illinois Manufacturers' Association.
The Traffic Club.
Union League Club.

in which they "earnestly urge the necessity of immediate relief."

A full copy of their statement is appended hereto.

Respectfully submitted,
URBAN TRANSPORTATION COMMITTEE.
E. J. Blair,
R. F. Kalker,
R. J. Brumley,
J. V. Sullivan,
H. H. Easterly, Chairman.
July 2, 1920.

STATEMENT PRESENTED TO Public Utilities Commission BY

Chicago Association of Commerce
Chicago Association of Credit Men
Citizens' Association of Chicago
Chicago Commercial Club
Illinois Manufacturers' Association
Traffic Club
Union League Club

There are now pending before the honorable body many applications by public utilities operating throughout the state for increases in rates and for other financial relief.

It is a matter of common knowledge and experience that the utilities operating in Illinois, and especially those in the City of Chicago, have been unable fully to meet the demands of the public for extensions and betterments to their properties and that, with few exceptions, the quality of the service rendered is unsatisfactory.

Our information is that conditions now obtaining will increasingly become worse unless immediate relief is afforded.

The financial status and need of the various utilities are well known to your honorable body, as well as the present state of the money market, which prevents even the stronger companies from obtaining additional capital in large amounts except at exceedingly high rates of interest. These conditions as a matter of business judgment, will cause the utilities to make only the absolutely necessary extensions and leaves them totally unable to anticipate future needs.

This inability to comply with the demands for public service is not only a serious and continuing menace to the commercial development of Chicago, but some of our citizens are in imminent danger of being deprived of necessary light and heat in their homes and transportation to and from their places of business or where they are employed.

Under the law of the State Public Utilities Commission is vested with the general supervision of all our public utilities, including full responsibility for service, adjustment of rates and the finances of the operating companies.

We are well aware of the grave character of the questions with which the utilities commission has to deal and of the great injury not only to the private interests but to the public at large that may result from errors.

The rates for service established by the commission must be reasonable both to the public and to the utilities, and a just and reasonable rate is necessarily a question of sound business judgment, rather than one of legal formula. The real test of the justice and reasonableness of any rate is that it should be low as possible and yet sufficient to induce the investment of capital in the business. Such rate must often be tentative; since exact results cannot be foretold.

We realize full well that the case of every utility must rest upon its own facts.

We shall not enter into the realm of controversy as to the causes underlying the present condition of public utilities in Illinois, neither shall we offer any plan or plans for the solution of the many difficult problems continuously presented to this commission. We do, however, earnestly urge the necessity of immediate relief, for we confidently believe that unless prompt action is taken even the present unsatisfactory public service cannot be maintained.

We respectfully suggest that, in all cases where it is impossible for the commission to give the case presented such an exhaustive consideration as will enable the commission to determine and prescribe a permanent rate or plan respecting the utility under consideration, tentative orders be entered covering experimental or temporary periods until such time as the experience of the commission or further investigation and deliberation will enable your honorable body to do complete and full justice in the premises.

The activity and amount of production in Germany is said by an investigator from Alsace to have impressed him more than anything else in Germany's industrial life. The factories run day and night and everyone is working to produce more, better and faster. They are working to re-make a great nation of Germany. The country is suffering, according to this authority, from politics, hunger and lack of raw materials, but in spite of all, Germany is producing. She is striving to produce what is lacking as a result of four years of war, especially what she can sell to the North of France and to crippled Belgium.

It is gratifying, in view of this, to be assured from several sources, that labor efficiency in the United States has increased during the past ninety days and that production is being consequently speeded up.

Organizing Conference Adopts Constitution

(*Continued from page* 14)

and Secretary of the American Engineering Council shall be respectively the Chairman and the Secretary of the Executive Board. There shall be two Vice-Chairmen elected by the Board from its members.

ART. V.—UNEXPIRED TERMS.

Vacancies in the offices of the President, the Vice-Presidents, the Treasurer and in the Executive Board and among the representatives on the Council shall be filled as soon as feasible by the agencies originally selecting the incumbents. Officers and delegates thus chosen shall serve for the unexpired terms.

ART. VI.—FUNDS.

Sec. 1. Funds for the use of the organization shall be contributed as follows:

(a) Each national society represented on the American Engineering Council shall contribute annually one dollar and fifty cents ($1.50) per member.

(b) Each local, state or regional organization or affiliation represented on the Council shall contribute annually one dollar ($1.00) per member. No portion of such funds shall be applied to the use of local affiliations or state councils.

Sec. 2. The American Engineering Council may receive and administer gifts, bequests or other contributions for carrying out the purposes of the organization.

ART. VII.—LOCAL AFFILIATIONS.

Sec. 1. Object. The American Engineering Council shall encourage the formation of local affiliations, to consider matters of local public welfare with which the engineering and allied technical professions are concerned, as well as other matters of common interest to these professions, in order that there may be united action and that suggestions and advice may be offered to the Council.

Sec. 2. Constitution. Each local affiliation desiring membership in this organization shall submit its Constitution and y-Laws and all subsequent amendments thereto to the Executive Board of the Council for approval of such portion thereof as may affect its eligibility, or its relation to the work of the Council.

ART. VIII.—STATE COUNCILS.

Sec. 1. Object. State Councils, consisting of representatives of local affiliations within the state or otherwise representative of the majority of engineers and members of allied technical professions in the state, if members of this organization, shall consider state matters of public welfare with which the engineering and allied technical professions are concerned, as well as other matters of common interest to these professions, in order that there may be united action in state affairs.

Sec. 2. Constitution. Each State Council desiring membership in this organization shall submit its Constitution and By-Laws and all subsequent modifications thereto to the Executive Board of the Council for approval of such portion thereof as may affect its eligibility, or its relation to the work of the Council.

ART. IX.—DELIMITATION OF AUTHORITY.

Local affiliations, state councils and the American Engineering Council shall deal with local, state and national matters respectively, and they shall be autonomous with respect thereto. It shall, however, be the duty of the American Engineering Council to interest itself in the activities of local affiliations and state councils if such activities are of national scope, or affect the general interest of the engineering and allied technical professions; provided, that nothing herein stated shall be construed as preventing the discussion by any local affiliation or state council or by the American Engineering Council of any matters of interest to engineers and members of allied technical professions, or action by the said Council on local or state matters where no local affiliation or state council exists.

ART. X.—PUBLICITY.

This organization stands for open meetings and such publicity as the By-Laws provide.

ART. XI.—AMENDMENTS.

Sec. 1. An amendment to this constitution may be proposed by the Executive Board.

Sec. 2. An amendment may be proposed in writing by at least 25 representatives on the American Engineering Council; such amendment shall be consideredted first by the Executive Board, which may approve, disapprove or formulate a modified or alternative amendment, report of which action shall accompany the original proposal to this organization.

Sec. 3. Any amendment proposed as provided in Sections 1 and 2 shall be considered at a meeting of the American Engineering Council and shall be submitted to its members at least 90 days in advance of such meeting. At this meeting, provided a majority of the representatives are present, the amendment may be rejected, or ordered submitted to the members of the Council for letter ballot within 30 days thereafter, with such modifications as may be adopted by a majority of those present. The amendment shall fail of adoption if one-third of the votes cast are in the negative.

BY-LAWS.

CHAP. I.—MEMBERSHIP.

Sec. 1. Qualifications. Any society or organization of the engineering, or allied technical professions, is eligible for membership, the chief object of which is advancement of the knowledge and practice of Engineering or the application of allied sciences, and which is not organized for commercial purposes.

Sec. 2. Admission. The Executive Board shall submit each application made to it on its prescribed form, to a letter ballot of the American Engineering Council, accompanied by a statement of its findings as to eligibility and the number of representatives to which the applicant would be entitled. The applicant shall be admitted by a majority vote of the Council, provided that not more than 25 per cent of the members of the Council shall vote in the negative.

Sec. 3. Termination of Membership. Any member society may terminate its membership on June 30 or December 31 of any year by at least three months' written notice to the Secretary; and, provided, the financial obligations of such organization are discharged to the said June 30 or December 31, respectively.

On complaint brought by any three members of the Council, and transmitted in writing to the Secretary of the Executive Board, alleging reasons why the membership of any member society should be terminated, the Committee on Membership and Representatives of the Executive Board shall investigate said charges, inform itself of all matters pertaining thereto, and report its findings to the Executive Board. The latter may dismiss the proceedings or make recommendations to the Council. The Council, by a two-thirds vote of those present at a meeting, may dismiss the proceedings or order a letter ballot; when the latter is taken, a two-thirds vote of the Council shall be necessary to terminate membership.

CHAP. II.—MANAGEMENT.

Sec. 1. Terms of Representatives. Representatives on the American Engineering Council shall serve for two years; provided, that after the first election, where there is more than one representative from one organization, approximately half shall be elected each year.

Sec. 2. Announcement of Representatives. Each organization represented shall send to the Secretary of the Council on or before August 15th of each year the names of its representatives who are to serve for the term beginning January first following.

Sec. 3. Votes of Representatives. Representatives on the Council and on the Executive Board shall each have one vote on these bodies.

Sec. 4. Meetings. 1. At all meetings of the National Council the order of business shall be as follows:

a. Roll call of Representatives.

b. Approval of minutes of last meeting.

c. Report of Secretary.

d. Report of Treasurer.

e. Report of President.

f. Report of Executive Committee.

g. Report of other committees.

h. Unfinished business.

i. Special business.

j. New business.

2. Rules of order. Unless otherwise provided, Roberts' Rules of Order shall govern the procedure of all meetings of the Council.

3. Quorum. A majority of all of the representatives of the Council

shall constitute a quorum for all of its meetings.

Sec. 5. Nomination and Election of Officers. 1. The Secretary shall send to each member of the Council at least 90 days in advance of the annual meeting nomination blanks for offices to be filled at that meeting. Nominations received within 30 days shall be canvassed by the tellers appointed by the Executive Board and reported by them to the Board. The Board shall place upon the ballot the names of the three candidates receiving the highest number of votes.

2. The Secretary shall mail to each member of the Council, at least 30 days before the annual meeting, a ballot containing the names of the nominees for each office.

3. Ballots received before 7 a. m. of the first day of the annual meeting shall be canvassed by tellers appointed by the Executive Board, and the result certified to the President of the Council, who shall announce the result of the election at the annual meeting. A plurality of votes shall elect; in case of a tie vote the annual meeting shall select immediately between the tied candidates by ballot.

Sec. 6. Duties of Officers. 1. The terms of all officers elected at an annual meeting of the Council shall commence on the adjournment of such meeting.

2. The officers shall have the usual duties pertaining to their respective offices, except as may be otherwise provided in the Constitution and By-Laws.

3. It shall be the duty of the President to represent the Council on any formal occasion.

4. The Vice-Presidents, in the order of their seniority of election and age, shall, in the absence or disability of the President, discharge his duties.

5. The Treasurer shall receive all moneys and deposit same in the name of the Council with a bank or trust company approved by it. He shall invest all funds not needed for current disbursements as ordered by the Executive Board. He shall pay all bills covering expenditures authorized by the budget or the Executive Board, by checks countersigned by the Chairman of the Finance Committee or some other member thereof. He shall make an annual report and such other reports as may be prescribed by the Executive Board. He shall give a bond at the expense of the Council, in amount and with surety satisfactory to the Executive Board.

6. The Executive Officer shall be appointed and his compensation fixed annually by the Executive Board and shall hold office during its pleasure. He shall be the Secretary of the Council and of its Executive Board. He shall manage the business of the Council under the direction of the Executive Board, and perform such duties as may be assigned to him by the Council or the Executive Board. He shall be the custodian of the property of the Council. He shall collect all money due the Council and transfer them to the custody of the Treasurer. He shall scrutinize all expenditures and use his best endeavors to secure economy in the administration of the business of the Council. He shall certify to the accuracy of all bills or vouchers on which money is to be paid. He shall give a bond at the expense of the Council in amount and with surety satisfactory to the Board. He shall pay the current expenses of the office and for this purpose shall have at his disposal a suitable sum of money to be fixed by the Board, which amount shall be periodically replenished under the authority of the Finance Committee upon the pre-

sentation of an account of disbursements in the form required by it. He shall mail to the member societies bills for their annual contribution 30 days ,prior to the beginning of the fiscal year. He shall perform such other duties as may from time to time be assigned to him by the Council or the Executive Board.

Sec. 7. Selection of Executive Board. 1. The Secretary shall submit to the Executive Board, at its September meeting, a list of member societies in good standing with their respective memberships.

2. The Executive Board shall thereupon determine the number of its members for the next ensuing administration year to be selected by national societies, and by the representatives of the local, state or regional organizations or affiliations, such members to be proportioned as near as may be to their respective memberships in good standing, and it shall prescribe the boundaries of each district.

3. The Secretay, within two weeks after the September meeting of the Executive Board, shall mail to the proper officer of each member society a copy of his report on membership and the Board's action with respect to the membership of the Board and its delimitation of districts.

Sec. 8. Attendance on Meetings. If any member of the Executive Board or any committee shall fail to attend five consecutive meetings he shall cease to be a member of such Board or committee.

Sec. 9. Duties of Executive Board. 1. The Executive Board shall organize within 30 days after the adjournment of the annual meeting of the Council.

2. It shall hold regular monthly meetings except during July and August. The regular meeting shall be held on the second Monday of each month except that a regular monthly meeting shall be held in connection with the meeting of the Council.

3. Special meetings may be called at the discretion of the President and shall be called at the written request of five members of the Executive Board.

4. The Secretary shall mail the notices of each regular meeting at least 15 days in advance thereof, and shall mail notices of each special meeting, stating its purpose, at least ten days or telegraph six days in advance of the date. No business, other than that for which it has been called, shall be transacted at a special meeting.

5. A quorum for all meetings of the Executive Board shall be fifteen members.

6. The Executive Board, unless otherwise provided, shall appoint all special committees of the Council and of the Executive Board. The membership of such committees may be drawn from the membership of the Council or of the member societies.

7. The Executive Board shall, whenever practicable, provide for the whole or a part of the expenses of representatives attending meetings of the Council and of the Executive Board.

Sec. 10. Appointment of Committees. 1. The following committees shall be appointed from the membership of the Board annually by the incoming President, with the approval of the Executive Board, each member to serve one year, or until his successor is appointed:

a. On Procedure.

b. On Constitution and By-Laws.

c. On Publicity and Publications.

d. On membership and representation.

e. On Finance.
f. On Public Affairs.

Sec. 11. Duties of Committees. 1. The Committee on Procedure shall act for the Executive Board in the interim between its meetings, and shall perform such other duties as may be assigned to it.

2. The Committee on Constitution and By-Laws shall report on all proposed amendments referred to it by the Executive Board, together with any modifications it may deem desirable.

3. The Committee on Publicity and Publications shall, when so requested, prepare all public statements and shall have the direction of publications of the Council.

4. The Committee on Membership and Representation shall report to the Executive Board on eligibility of each applicant for membership and the number of representatives to which it would be entitled. It shall review and report at least 90 days before each regular meeting of the Council the number of representatives to which each member society is entitled. It shall review the existing electoral districts and report thereon to the Executive Board at least once every two years. It shall report on all questions regarding registration and credentials of representatives on the Council.

5. The Finance Committee shall have supervision of the finances of the organization. It shall report an annual budget to the Executive Board. The chairman or some other member of the committee shall countersign all checks for the payment of money.

6. The Committee on Public Affairs shall report to the Executive Board on all public affairs with which the Engineer is concerned or which affect the relation of the Engineer to the public.

CHAP. III.—FUNDS.

Sec. 1. Fiscal Year. 1. The fiscal year shall begin on the first day of January of each year.

2. The contributions of each member society shall be payable in advance in semi-annual payments, on the first day of January and July of each year, and shall be based upon a certified statement of its membership as of January first.

3. A member society failing to pay its semi-annual contribution within six months after it is due shall be suspended or dropped from membership, at the discretion of the Executive Board.

4. Funds shall be disbursed, as authorized by the budget or the Executive Board, by checks signed by the Treasurer and countersigned by the Chairman or some other member of the Finance Committee.

CHAP. IV.—PUBLICITY.

1. Privilege of attendance at meetings of The Federated American Engineering Societies and the American Engineering Council, except during executive sessions, may be extended to proper persons, who may be authorized to make copies of papers and records.

2. The Publicity Committee may engage a publicity secretary to co-operate with the trade and general press.

CHAP. V.—AMENDMENTS.

Sec. 1. An amendment to these By-Laws may be proposed by any representative of the American Engineering Council or of the Executive Board. The latter shall consider all proposed amendments and mail a copy of such amendments, together with its report thereon, to each representative on the Council at least 60 days prior to the date of a regular meeting.

Sec. 2. These By-Laws may be amended by an affirmative two-thirds vote of all representatives on the Council present at a regular meeting thereof; provided that the proposed amendment shall have been mailed to each representative at least 30 days in advance of such meeting.

Sec. 3. Sections 2, 4 (paragraph 1), 5, 6 (paragraphs 3, 4, 5 and 6), 7 and 10, of Chapter II of these By-Laws, and any By-Laws adopted subsequent to ...., may be amended by a vote of three-fourths of the members of the Executive Board at any regular meeting; provided that the proposed amendment shall have been presented in writing at a previous regular meeting of the Board.

EMPLOYMENT SERVICE

Do you need assistants?

Do you want a position?

Do you feel that you have men in your employ that are needed more in some other position?

Do you wish a change or advancement? The service we render is to bring men together for their mutual benefit. In order to do this, we offer free of charge, this Employment Service. Will you use it?

Positions Available

A-70: WANTED—STRUCtural designer with mech. experience; familiar with coal and ore handling machinery; salary $250 per month.

A-71: GRADUATES WHO DEsire to connect with a large manufacturer of miscellaneous electrical household appliances; located in Chicago, Ill. We need four men from 1919 or 1920 graduate class who are ready to spend one or two years learning the details of engineering, sales, production or manufacturing department.

A-72: WANTED — MECH. ENgineer to take entire charge of mech. department of large industrial engineering firm in Chicago; thorough knowledge of power plant, heating, plumbing, ship equipment, etc.; salary, $5,000 to $10,000.

A-73: WANTED — ENGINEER with experience on the design of machinery and plant layouts, to take charge of the Engr. department of medium sized manufacturing plant near Chicago; location ideal.

A-74: WANTED—MEN ABLE to handle inspection work on building construction and also to be available for building and mechanical drafting.

A-75: INSTRUCTORS IN VArious departments of well known state university; vacancies in architectural, civil engr., electrical engr., mech. engr., theoretical and applied mechanics, physics and railway mech. engr. departments; salaries, $1600 to $1800 for 10 months, depending upon qualifications of candidate.

A-76: WANTED—2 DESIGNERS, steel; 1 designer, reinforced concrete, experienced in flat-slab construction; 6 shop detailers, steel. Permanent position for satisfactory men with Chicago engineering firm.

Positions Wanted

B-700: MECH. ENGINEER specializing in machinery design, factory maintenance, extension, investigations and reports; available for such work on part time basis.

B-701: GRADUATE MECH. ENgineer, best references, open for power plant, testing and electrical engineering; technical writing or sales engr. work.

B-702: A-1 STRUCTURAL ENgineer and designer open for position in Philippine Islands or other foreign work; married; will consider two-year contract with expense for moving.

B-703: CORNELL GRADUATE, C. E. 1919, with experience in surveying and construction, wants position, preferably with railroad terminal construction project.

B-704: ENGINEER NOW EMployed; having experience: railway location and foundation work, Ry. construction, fixed and movable bridge design and construction; major with Canadian railway troops overseas; open for position where he can make use of his experience as executive and handling men; salary, $5,000; best references.

B-705: FIRST CLASS DRAFTSman desires work on construction details for private parties.

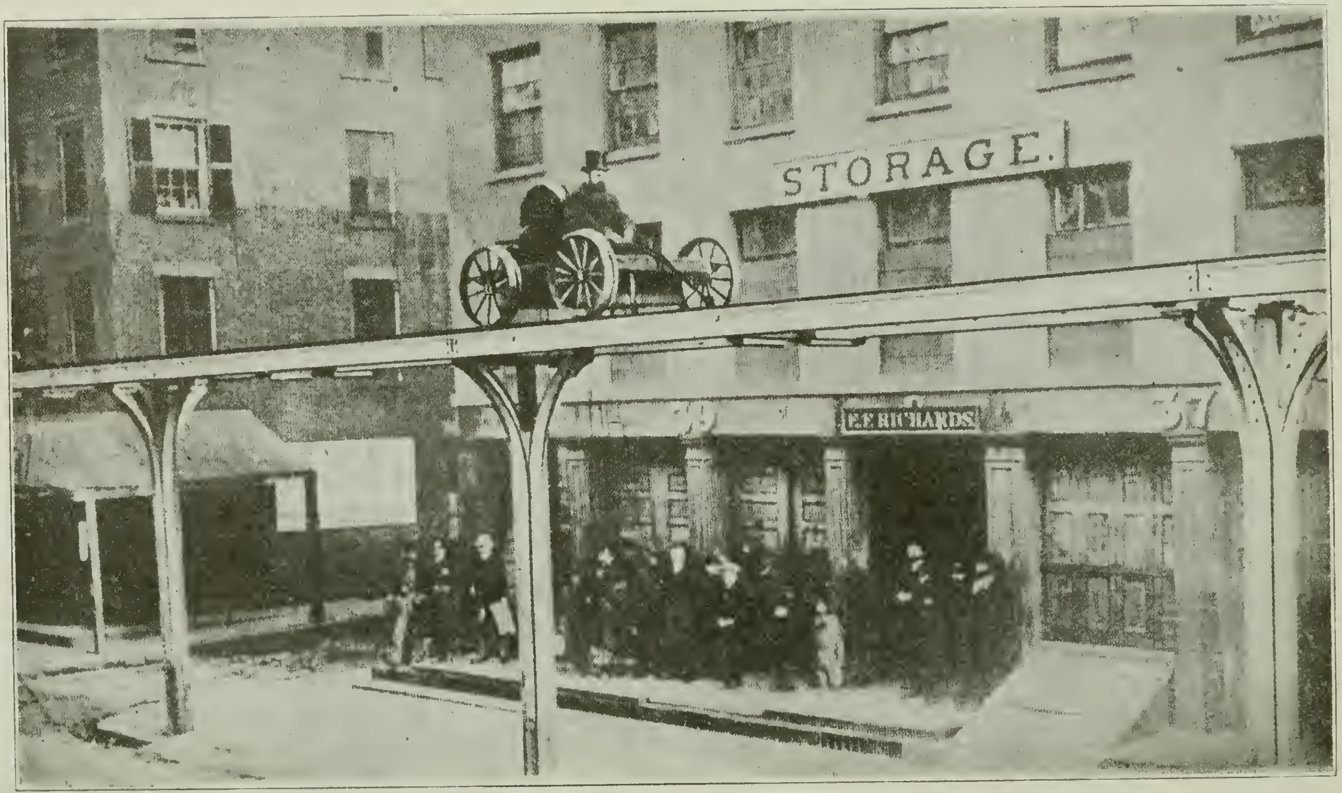
B-706: GRADUATE MECH. ENgineering Univ. of Wisconsin, with especial qualifications along steam and gas engineering lines available for position in such work.

B-707: DESIGNER ON CONcrete and industrial buildings and estimator who can take care of office work and who is familiar with sub-contracts in above work, desires outside work; eight years experience; best references.

B-708: ENGINEER, AGE 45; married; with good technical education, having broad general experience; thoroughly familiar with construction work, surveying, drafting room practice, machine design and shop practice, including actual operation of various machine tools; has done research work on clay products and smelter practice; will consider position as chief engr. or supt. of construction on construction work or manufacturing plant; salary, $5,000; best references.

B-709: GRADUATE C. E., Northwestern University; has had experience in general construction work, road construction and was asst. engr. of large city; desires position as supt. of construction; designer, structural steel or reinforced concrete, or as estimator.

B-710: MECHANICAL ENGIneer, age 35, technical education, thorough knowledge of the designing of power-plants, heating, ventilating, plumbing and fire-protection; can take entire charge of mechanical department of an architectural or engineering firm, including the making of plans, specifications, estimates, reports and the superintending and testing of installations; best references.



"Back Sights." First elevated railroad in Greenwich St., New York, 1867, Charles T. Harvey operating car by cable power.
(James Blaine Walker, "Fifty Years of Rapid Transit.")

TECHNICAL SECTION

JOURNAL OF THE
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City Building and Transportation

Some of the Technical Relationships Involved. The Great Need of Broad Vision, Executive Skill, and Courage. A New Field for the Technical Profession.

BY JAMES ROWLAND BIBBINS, M. W. S. E.,
Supervising Engineer, The Arnold Company, Chicago.

Presented May 12, 1920.

INTRODUCTION

"THE INDISPENSABLENESS OF CITY PLANNING"[1]

CHARLES W. ELIOT
President Emeritus, Harvard University

> "Good planning for cities and closely built towns and villages is not primarily a matter of aesthetics, but of economics. The main object is to prevent or remedy the physical and moral evils and losses which accompany congestion of population. To effect this object it is necessary to prevent the corruption of the air the people breathe night and day, of the water they drink, and of the foods they eat; and to this end well-ventilated dwellings, shops, and factories, a pure and abundant water supply and a safe sewage disposal, and rapid transportation and prompt delivery for foods are all indispensable. There must also be provided rapid transit for passengers and all sorts of goods into and out of the city, else the population will not be spread over a sufficient area and the industries which support the people will not be carried on advantageously.
>
> "The laying out of most American cities has been casual and thoughtless of future needs. The common rectangular layout, without any well-considered diagonals, causes a great daily waste of human and animal labor and of fuel, while high buildings, narrow streets, and lack of open spaces make it impossible to keep the cities well aired and well sunned. To improve or reform the layout of most American cities is, therefore, a great public need, not only for beauty's sake, but for the sake of health, efficiency, and happiness of their people."

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[1] By courtesy of John Nolen, Report on "Replanning" of Reading.

ARE we developing into automata in our community life? Must efficient cities become mechanical cities?

In choosing the title of this paper, the author has used, advisedly, a new term, "City Building." It savors more of dynamic than static forces and seems to hold a broader conception of the subject under discussion than conveyed in the usual term, "City

Planning," which most people associate more with the purely aesthetic idea of the City Beautiful than with the practical and perhaps more needed City Efficient. Let no man conclude that the aesthetic features of City Planning are not vastly important and fundamental to the preservation of wholesome and enlightened community life. But the fact stares us in the face that we must also attain the City Efficient, and that soon.

The quoted introduction to this paper, drawn from the pen of Chas. W. Eliot, expresses with a remarkable breadth of vision an ideal which the technical profession may well accept as fundamental. While many able men generally associated with the architectural features of City Building are devoting thereto their genius and abilities, it seems an unfortunate fact that the technical profession as a whole is often disposed to relegate City Planning to the limbo of imponderables. But, curiously enough, the wheel of Fortune turns and today captains of industry are busying themselves with vast housing and transportation plans, as well as building factories; indeed, transportation problems have become crucial.

In 1890, 36 per cent of our population dwelt in urban communities; in 1910, 46 per cent; New England, 83 per cent. The first ten cities contained about 14 percent of the total urbanites. The new census indicates a still further trend of movement from the country to the cities and throws into bold relief the serious national problems of food supply and economic stability.

There are two alternatives: First, neglect our cities, so as to drive the disgusted people back to the land, or, second, render them so efficient as to decrease the cost of living, production, and distribution, and thus eliminate the competitive differential between farmer and urbanite. Mr. Herbert Hoover recently addressed himself to this problem by demanding a solution for this dangerous differential through the aid of the technical profession.[2]

Again, Gen. Leonard E. Wood, in a remarkable impromptu address, pleads for a closer union of effort among engineers and architects in City Building and Administration—a unity of effort which should be carried to the floor of every council chamber and, in the larger sense, to the Congressional halls and the Cabinet.[3]

Finally, John Maynard Keynes, in an epochal analysis of world economics, traces with the skilled mind of the economist how disaster came to Germany, and will come to other peoples at war who cannot control the essentials of their economic life and at the same time develop capacity production.[4]

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[2] Address, Washington Award Dinner, Western Society of Engineers, February 3, 1920:

"The outstanding feature of civilization during the last century has been the increasing growth of industry as distinguished from agriculture."

"It is in all these directions that, I believe, lies the best field for restoration of balance between agriculture and industry. We want our industries to develop, but we want agriculture to keep pace. So long as we can feed our industrial population, the greater industry grows, and the greater is our whole community."

[3] Address, Western Society of Engineers, Annual Dinner, 1920:

"I want to suggest that you form an offensive and defensive alliance with the architects and try to evolve some general policy of construction in our great cities. We have sanitary regulations. The construction of public buildings and private residences is governed to a certain extent, but we have no regulations which prevent monstrosities of construction from being inflicted upon the public. A combination of the architects and engineers in a determined effort to secure utility and lines of beauty would be a decided benefit to any city."

Already the United States is an importer of fuel oil in the face of tremendous expansion of its use for railroad, steamship, and industrial power and the appalling growth in automobile transportation. It may soon be an importer of foodstuffs if the lure of the city increases.

An industrial city is like an industrial nation, depending upon imported food, and generally raw products, too. This means a nation of big, congested cities, with their grave problems of transport — electric railways, railroads, waterways, highways, harbors and marine transport. It means busy docks, dense passenger and freight movement, complicated terminals, rush hour traffic congestion, high labor turnover in the factories, difficulty in maintaining standards of living among the ignorant working class, problems of food distribution, merchant or package transport within the city, industrial wastes, the broad questions of housing, zoning, and the City Plan; the race problem in all its ugliness, and, above all, the culmination of these various factors in the high cost of living, industrial unrest, and labor turnover. But out of all these bewildering difficulties, perhaps the most important fundamental point of attack is that of transportation.

What, then, is needed to measure correct city development?

We cannot plan too far ahead. Yet the city builder who predicts developments far into the future is often branded by narrow or short-sighted people as visionary. But the charge is grossly unfair. The last census indicates in a large number of important cases increases of 25 per cent or over in city population during the last decade, in spite of the war and the excess of emigration over immigration (Akron, 240 per cent; Muskegon Heights, 450 per cent). Should we think it safe to ignore the presence of the dangerous tendencies above related, it is only necessary to review contemporary history or to take a back sight, as it were, for only 50 years.

Here are some glaring examples of pure expediency, which give at once some measure of the dimensions of our problem:

(1) City of Pittsburgh, with its "hump" removal of only 14 feet, largely to suit certain building interests and quiet the unthinking opposition of the taxpayers, although the deeper cut was advocated by practically all enlightened civic bodies and authorities.

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[4] "The Economic Consequences of Peace":

"This great increase was only rendered possible by a far-reaching transformation of the economic structure of the country. From being agricultural and mainly self-supporting, Germany transformed herself into a vast and complicated industrial machine, dependent for its working on the equipoise of many factors outside of Germany as well as within. Only by operating this machine continuously and at full blast could she find occupation at home for her increasing population and the means of purchasing their subsistence from abroad. The German machine was like a top, which, to maintain its equilibrium, must spin ever faster and faster."

(2) New York still regards Jersey City and suburbs as a railroad yard for its service, and Brooklyn as its bedroom, and with a piecemeal rapid transit system which prevents the installation of a standardized service through the length of the most important highway in the world—Broadway, should it be required.

(3) San Francisco—rebuilt after the fire without a single betterment of its atrocious street plan, although an admirable city plan had been previously developed by D. H. Burnham and the essentials of this plan especially selected by a group of enlightened citizens for immediate adoption after the fire. It has truly been said that Ruef and Schmitz cost San Francisco more than the fire and earthquake.

(4) Cleveland—permitting a disruption of its splendidly conceived Mall plan to suit one group of railroads, without threshing out fully the merits of the original plans before abandoning them.

(5) Oakland-Berkeley — permitting over-development of its excellent rapid transit system by a competitive system so manifestly uneconomic as to result in the certain failure for one or the other company; as expected, it was for the company which originally established the unique suburban service of the Key Route System.

And, lastly, Chicago, big in square miles and possibilities, but apparently impotent to develop efficient transportation for its growing millions, except as paper for fuel in political bonfires.

Procedure: The above instances should suffice to establish in the minds of the technical profession the great necessity of applying experience, fairness, and judgment to these great problems of City Building. And we may as well mention here, at the start, certain matters of procedure which appear to the writer to warrant special attention.

1. Excess condemnation for public improvements, by which the acquisition of the necessary land may be carried out without involving the laborious and expensive legal procedure now necessary to adjust compensatory damages for the part of the land tracts not taken. In the Michigan Avenue improvement, fragments of only a few feet had to be adjudicated, whereas the City should have had the right to acquire complete parcels of any shape necessary for the improvement, and resell the balance. In fact, only by this method can the City control the ultimate character of improvement along the frontage—a far-sighted provision long since adopted by foreign cities.

2. Local district assessment for non-paying extensions: Fundamentally, there is no reason why a transit extension into undeveloped territory should not be subsidized just the same as any other utilities—at least, such a method will often secure service long before service can become self-supporting, and therefore justifiable, on a cost-of-service basis.

3. Frontage consent amendment, to make possible the carrying out of public works in the general interest and avoid long years of obstruction by a few unreasoning property holders. A San Francisco street, two-thirds paved in scattered sections, was observed to be actually impassable because of the gaps caused by a few objecting owners. The same applies to transit. In Chicago a single damage suit against the construction of the Union Loop, still unsettled, was made the basis of $16,000,000 appraised liability against the Elevated for hypothetical damages supposed to be suffered by owners of abutting property, the value of which had already been increased enormously by the very presence of the rapid transit line.

4. Consolidation of condemnation suits in improvement proceedings, so as to avoid the enormous expense and delay in dealing with individual owners, ranging in number perhaps as high as 1,000 persons.

5. Regulation of tramp carriers or jitneys or suppression, except these submit to equitable supervision, so as to secure the continuous and responsible public service required of any common carrier. It is vastly more important to conserve the stability of the responsible established transit systems in the interest of the whole city.

6. Road Tax Assessment of vehicles according to size, weight, use, and probable wear on public streets. There seems no justification for singling out other transportation utilities to bear city assessments alone.

7. Comprehensive street paving program, covering the design, crowning, surfacing, and maintenance, so as to facilitate segregation of high speed and low speed traffic routes and to unburden the transit lines from the ridiculous delays now encountered through obdurate drivers.

8. Control of front-door delivery in the congested districts, vehicle parking, trucking routes, and securing the needed right-of-way for transit lines.

9. Foods and market products: Control and organization of transportation and distribution. South Water Street, Chicago, should be a sufficient example.

10. Cost-of-service franchises, with flexible fares on the "paydown" plan, not simply the "out of pocket" cost of the moment—that is, with rates based upon the full cost of service necessary to insure the standards required by the community and to maintain the physical integrity of the property on a permanent stable basis.

11. Conservation of utilities essential to the public welfare, and necessarily monopolistic in character, with a form of experienced public regulation which will prevent the repeated disastrous declines in utility properties and service due to terminating franchises, political raiding, and deliberate destruction of credit.

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Group Action by the Technical Profession Needed: The far-reaching character of the above suggests practical difficulties of public policy and procedure calling for the most careful consideration of the technical profession which preëminently is best qualified to ascertain and prescribe the constructive needs of the community. To secure these results will require united action and skilled representation before various legislative bodies, and also a sustained campaign of education for the benefit of the general public. This group action should be directed along certain practical lines calculated to secure the best results, thus:

1. *Legislation:* To develop and secure the passage of remedial or enabling legislation, either local or national.
2. *Publicity:* To secure the widest public discussion of worthy projects on their merits, and avoid political jug-handling.
3. *Coöperation:* To promote effective action by all essential agencies, to the end of the greatest public good to the greatest number.
4. *Physical Plans:* And, finally, to see to it that the requisite experiences and technical skill be used in developing and executing the physical plan.

BACK SIGHTS—FIFTY YEARS

Coming now to specific discussion of our problem of the technical relations of City Building and Transportation, it will be profitable to turn back a few pages of contemporary history, and no more illuminating pages have been written than those concerning old New York, beginning with the turbulent period of the Civil War.[5]

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[5] James Blaine Walker, "Fifty Years of Rapid Transit":

"Whoever shall undertake hereafter to present a philosophic history of these times will be compelled to linger over and to emphasize the fact that during the bloodiest epoch in their national career the progress of the American people in social and political enterprise outstripped that of any previous period from the founding of the Commonwealth." * * *

"In order fully to appreciate the power of these factors, * * * we have first to remember what the New York of 1865 was. Above Forty-Second Street it could scarcely be said to exist, being only a dreary waste of unpaved and ungraded streets, diversified by rocky evidences crowned with squatters' shanties. Railway passengers from the north still left their trains at Twenty-Seventh and Thirtieth Streets. Street railways were comparatively few, and there was no speedy and comfortable way of getting from one end of the city to the other. Below Eighty-Sixth Street there were in 1865, 25,261 vacant lots. The grading of Madison Avenue was still in progress, and the state of the city as regards transit facilities is set forth in a striking way by the hopeful language in which a pamphlet of that day speaks of the new street as likely to 'prepare the way for an extension of the Fourth Avenue Railroad,' and thus give new access to the Park. Unable to get anywhere on Manhattan Island, people sought the suburbs and rapidly built up Southern Connecticut and Eastern New Jersey, with Long Island and Staten Island." * * *

"According to figures compiled by Sharp in one of his campaigns for a franchise, about 230 omnibuses passed Chambers Street going up Broadway, and 240 down, each hour. For 13 hours his count, taken in August, 1852, showed that 3,035 omnibuses and 4,719 other vehicles passed up, and 3,162 omnibuses and 4,723 other vehicles passed down Broadway at this point. This meant an omnibus service at 13 seconds' headway.

"By the year 1864 conditions had become intolerable. Broadway became unsafe for pedestrians, and we are told that the rivalry between omnibus drivers was so great that they recklessly drove over men, women, and children in their haste to beat their nearest competitors to waiting passengers. In the rush hours the omnibuses were so crowded that passengers had to hang onto straps, as they were forced to do in the more crowded street cars. As omni-

It is a curious commentary on the superficiality of the city dweller that "forty years later (1904) newspapers were writing the same kind of editorials, but in the place of calling for a cab system they were hammering the Rapid Transit Commission for not providing more subways." It is remarkable that an engineer, Mr. A. P. Robinson, as early as 1864 should have predicted with extraordinary clearness and foresight the actual development of Manhattan and designed a subway line up Broadway, which, however, was defeated through the curiously short-sighted opposition of Governor Fenton, who vetoed the subway.[6]

Yet, later, Battery Park became the terminal of an elevated system, far more unsightly and conspicuous than Governor Fenton ever dreamed of. In general, Robinson's findings are well summed up in the conclusion "that outlying growth would demand longer haul and that higher speed of transit would be a necessity." Curiously enough, he anticipated a further necessity which is not yet fully appreciated — that to develop the earning capacity of the system, "transportation of freight at such hours of the night as would not interfere with the passenger business" would be desirable. Today this applies with greater force as one of the justifiable means of increasing revenues and keeping down passenger fares.

The West Side railroad problem of street obstruction was a serious one as early as 1866. "The traction of freight and passenger trains by ordinary locomotives upon the surface of the streets is an evil which has already been endured too long, and must speedily be abated." This problem still remains in the realm of discussion and contest.

In the early '60s pneumatic tube subways were also proposed by the engineers, M. O. Davidson and Alfred E. Beach. The cars were to be blown from station to station by huge engine-driven fans giving a pressure of 3 to 7 ounces per square inch, and Mr. Beach actually constructed a tunnel in Broadway 9 feet in diameter, driven forward by the hydraulic shield method—the first application of this plan used in America.

Today New York, with its great dual system, is still confronted

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[6] "It might be possible, through financial disasters or other causes, that the central thoroughfare of our commercial metropolis would be obstructed or unsettled for a vexatious period. * * * I cannot consent, on my part, to the use of these (public) grounds without feeling that I had violated the trust imposed in me by the people."

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bus fares were ten, and the street car fares six cents, the latter carried by far the greater number of passengers. The newspapers of the period denounced the conditions and scored omnibus and car companies. Reckless driving and crowded omnibuses were not the only grievances. The drivers were accused of swearing at passengers and giving them bad money or tickets in change."

* * *

"Modern martyrdom may be succinctly defined as riding in a New York omnibus. The discomforts, inconveniences, and annoyances of a trip in one of these vehicles are almost intolerable. * * * The driver swears at the passengers, and the passengers harangue the driver through the strap-hole — a position in which Demosthenes could not be eloquent. Respectable clergymen in white chokers are obliged to listen to loud oaths. Ladies are disgusted, frightened, and insulted." * * *

"The cars are quieter than the omnibuses, but much more crowded."

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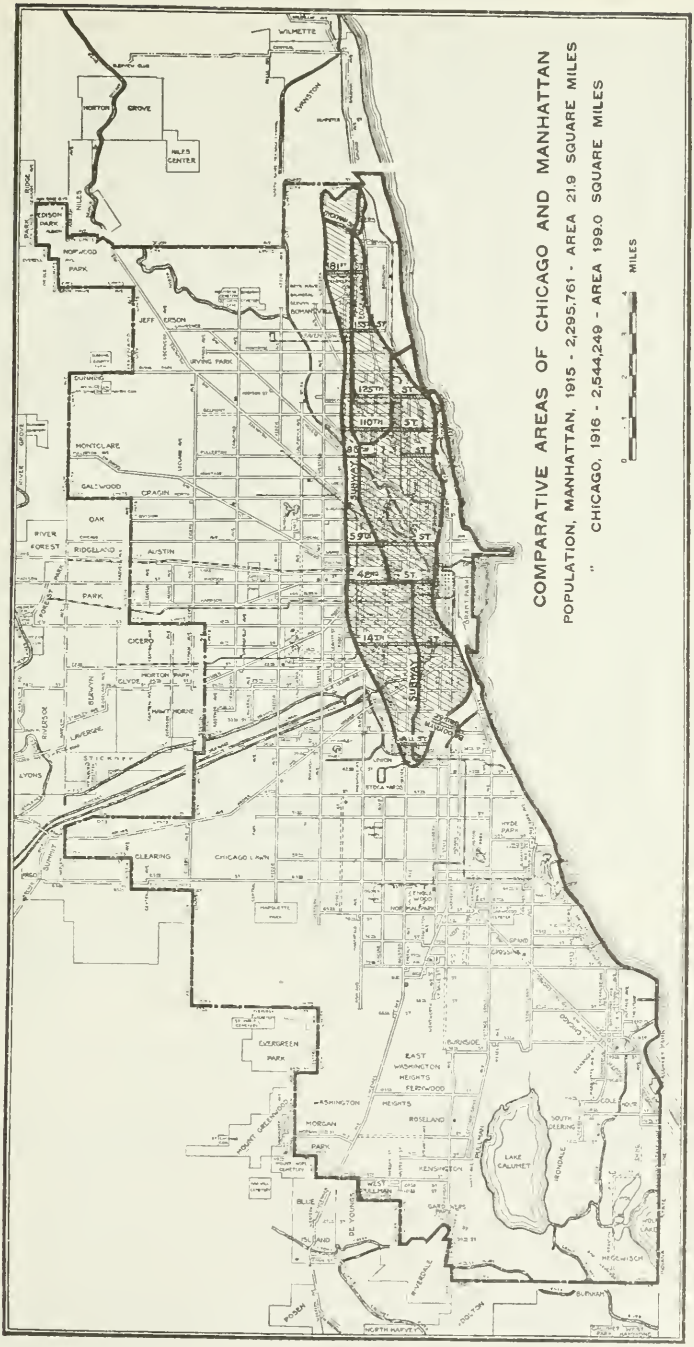
by the fact that Broadway, the most important continuous business street in the world, extending along the ridge of Manhattan Island, has three pieces of subway which are not standardized and will probably never be connected as a continuous line.

Experience in other cities is similar. Pittsburgh had three systems of transportation on Federal Street (Allegheny)—horse, slot conduit, and double overhead trolley. Here Henry developed his first electric motor propulsion system, and here, also, passengers were carried up from the South Side hills by means of a steam dummy driving from a rack gear laid in the street. Later horse car lines were replaced by mechanical cable, one line of which was in operation only six years before being replaced by trolley; some of it abandoned before completion.

In San Francisco the mechanical cable system still survives, because of the atrocious city plan, by which San Francisco was laid out from the Market Street base line, with no attention whatsoever paid to natural contours. Here street grades of 10 per cent are common, with trolley lines operating on 17 per cent grade. One paved street has a 33 per cent grade. In Providence, modern car operation has long been carried out in a street 35 feet wide, without room for both passing cars and standing vehicles. In old Boston the ancient street plan has practically forced the elimination of surface transit lines downtown entirely. In modern Los Angeles we find five-car heavy interurban trains operating in the narrow city streets. In Baltimore, boasting the first electric road, two steam traffic tunnels were laid out and built with almost prohibitive grades, so that a new railroad trunk line through the city is now under consideration, probably elevated. Here the electric button contact system was first installed on a large scale, to haul trains through the B. & O. tunnel. In Syracuse the city gradually developed about the old Erie Canal. A transcontinental railway still operates along the main axial street of the city, on the surface.

At the Chicago exposition was operated the first extensive moving sidewalk system, recently recommended for Forty-Second Street, New York. And the first monorail system was built in suburban New York to City Island, unfortunately less substantial than needed for safety and permanence. Now monorail systems flourish, but apparently only in legislative atmospheres—one rail, cars suspended; two rails, suspended; three rails, etc., the latter proposing the unique feature that increased traction for climbing grades would be produced by compressed air pistons squeezing the wheels tighter against the rail as the grade increased. Storage battery systems have come and gone, and again returned for lines of light traffic density, as in New York.

In Chicago, like other cities, came the divisional system of operation—North Side, West Side, and South Side—and, successively, horse, cable, and trolley. The slot conduit system was seriously proposed just prior to the recent rehabilitation of the surface line properties. Fortunate, indeed, that Chicago was not burdened



Comparison of Cities Dangerous without due regard to area and density. Chicago's transit problem a serious one. (a) with the tremendous capital investment that later brought financial disaster to the New York lines.

But the crowning incongruity is that Chicago's elevated system, comprising a nucleus of perhaps the best and cheapest rapid transit systems in the country, should today be forced to operate under physical handicaps well nigh impossible. For 13 main line rapid transit tracks enter Chicago's Loop, while only two tracks are permitted to traverse the Loop district for rapid transit purposes. The surface lines have been unified in one operating system, and their rehabilitation following the 1906 ordinances resulted in an immediate relief, shown by the decrease in elevated traffic, but soon surface line traffic caught up with the capacity of even the new system and traffic again returned to the elevated, which, in turn, was forced to through-route to operate with even fair satisfaction. Now both surface and elevated are overloaded and the traffic grows apace. At least five extensive reports have been prepared by public authorities, special commissions, and independent engineers. But still no subways and no constructive plans for bringing about a stable and progressive relief of the consequence of growth.

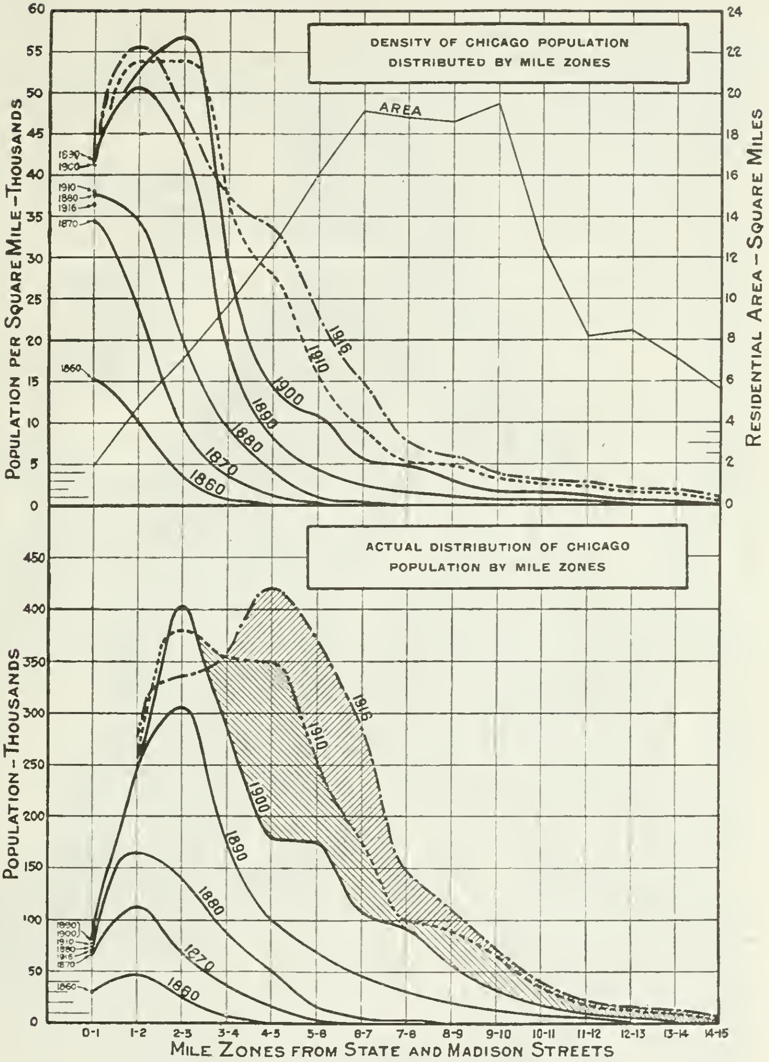
Today, fortunately or otherwise, Chicago can start its subway development de novo without serious complications or embarrassing heritage from the past, without serious physical obstructions, with every promise of financial stability, provided reasonable care and judgment are exercised in not over-building at the start and securing the necessary coördination of the existing facilities and the future developments and extensions. The "back sights" above mentioned throw into bold relief young Chicago as compared with the older cities, in that *Chicago's hands are unshackled.* What will the city do with its unusual opportuinty? Here, indeed, is a challenge to the technical profession which it must meet or acknowledge civic impotence.

THE CITY AS AN INDUSTRIAL PLANT

Perhaps a clearer conception of both internal and external elements of proper city development may be had by considering the city broadly as an industrial plant.

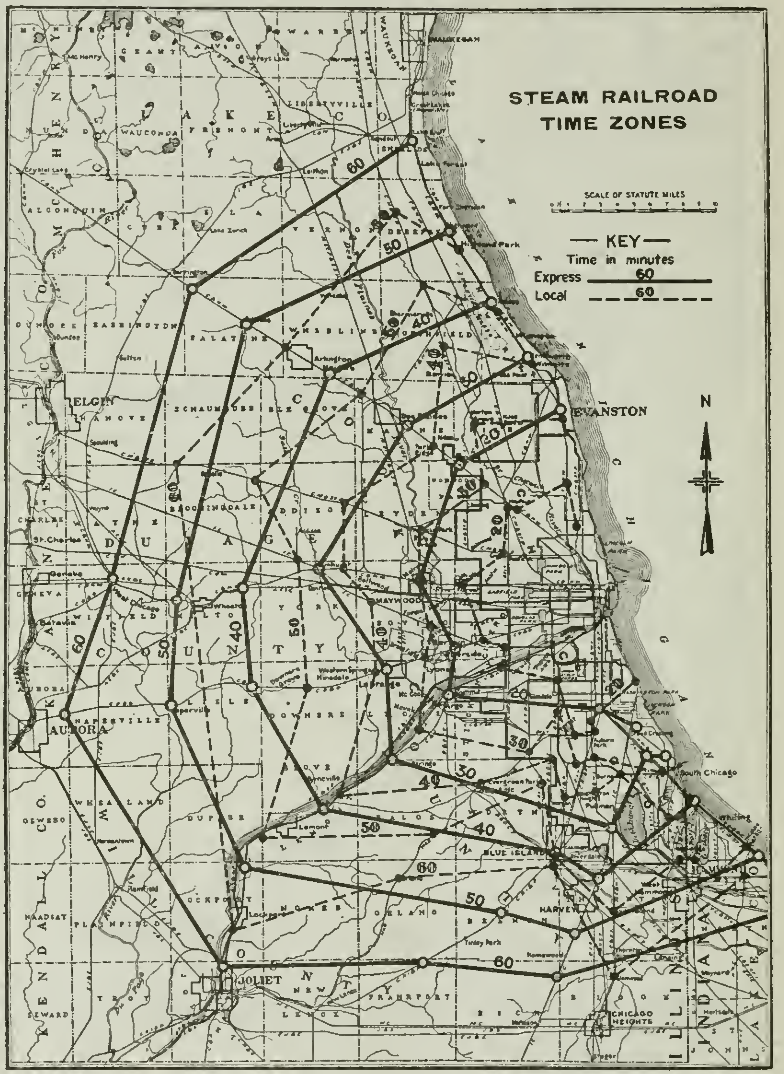
I. THE SITE—THE PHYSICAL PLAN OF THE CITY.

Old city areas and expansion. The United States census now discusses all large cities under the term "metropolitan districts," thus recognizing that geographic and political boundaries should have relatively little weight in working out the problems of growth of a great city, and that the boundaries of the commuter zones really fix and determine the transportation problem. Foreign peoples have recognized this, in the Administrative District of London and the Department of the Seine in Paris, yet until recently it was difficult to find a published map of the New York District incorporating the enterprising industrial centers on the Jersey side, which



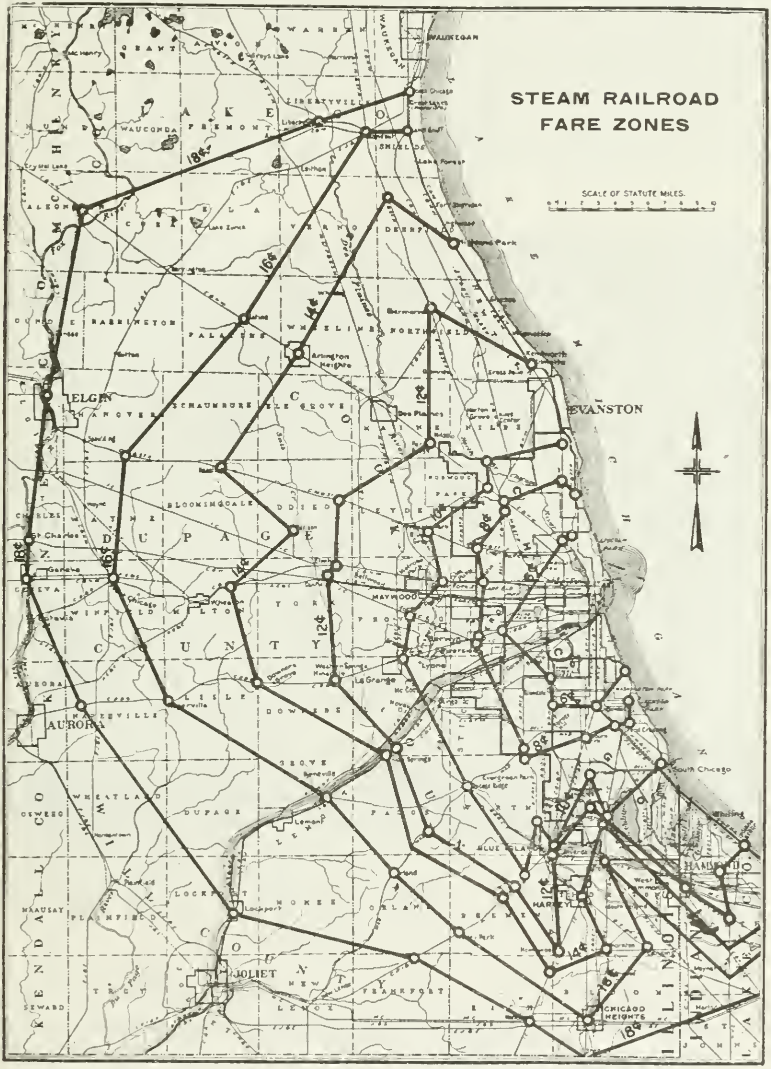
The Stone in the Puddle, illustrating the waves of maximum density receding from the center, with successive decades of growth. Compare with the upper curve of area. (a)

are as inextricably associated with the business life of Manhattan as the Borough of Queens. If we consider Forty-Second Street as the new business axis, just as is Madison Street, Chicago, Manhattan Island will extend only from the Stock Yards to the north city limits of Chicago. Yet Chicago voters were called upon to authorize an independent competitive subway extending throughout Chicago's 200 square miles, regardless of the tributary density. As cities expand, length of haul increases from a radius of two to three miles in small cities up to 15 or 20 miles in



The Thirty Minute Time Zone determines the residential city area more than the city limits. Transportation knows no geographic boundaries (a).

the larger ones. Chicago is 26 miles long, with one street 23 miles long and one car line 22 miles long. Up to the war, the universal 5-cent fare was retained only by increasing density and diversity of travel, varying form two miles per passenger ride in small communities to perhaps three and one-half miles, as in Chicago. Curiously enough, the longest through route in Chicago has a comparatively short average haul, and in preserving a reasonable average haul lies the whole economic problem of transportation.



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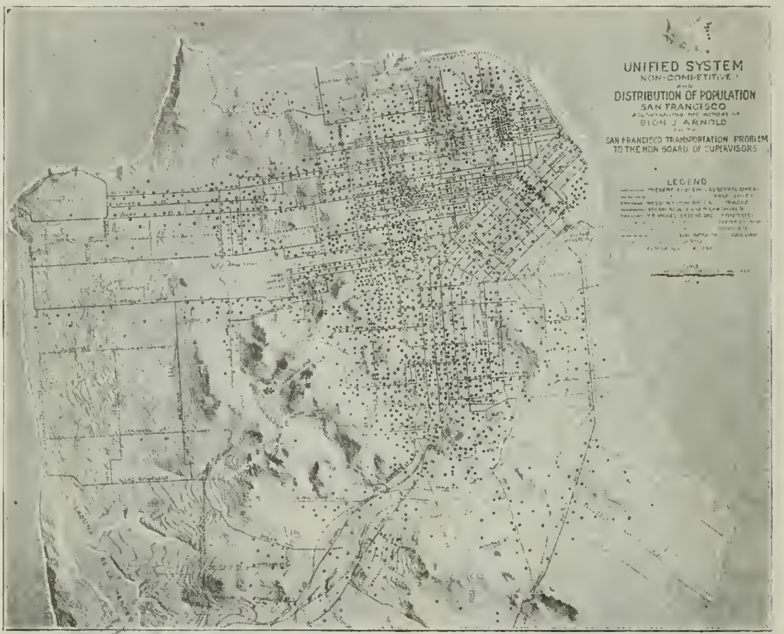
City vs. Suburbs. The urge of the country and how railroads favor long hauls. Contrast with the exactly opposite policy of transit systems within the city. (a)

30-Minute Time Zone: Obviously, city expansion must cease when the time consumed and fare become burdensome to commuters. And it seems to be a general fact that the metropolitan district is largely determined by the 30-minute time zone. Thus it occurs that through the agency of steam suburban service the commuter suburbs stretch away for 15 or 20 miles in all directions, depending entirely upon the connecting link of transportation.

In many cities the steam suburban fares are so adjusted as to favor the long distance riders to such an extent that the outlying fare *per passenger mile* may actually be as low as half that for city stations. While a discrimination against the city, this is a partial admission of the "one city" idea and undoubtedly advances the development of desirable suburban residential districts. The same principle is, of course, involved in the one city, one fare transit plan, where the short-haul rider contributes to the long-haul rider purely in the interest of decentralization and wholesome residential development in the broad acres of the suburbs.


UNIFIED SYSTEM
NON-COMPETITIVE
AND
DISTRIBUTION OF POPULATION
SAN FRANCISCO
ACCOMPANYING THE REPORT OF
BION J. ARNOLD
ON THE
SAN FRANCISCO TRANSPORTATION PROBLEM
TO THE HON BOARD OF SUPERVISORS
LEGEND

God's Country and the Ruler: Man-made street plans sometimes inferior to those of the lower animals. Note extraordinary opportunity for contour street development. Utilities determine settlement. San Francisco Twin Peaks Tunnel has given new life to the Sunset Dunes. (b)

The intense financial difficulty brought about by the war has brought into increasing contrast the two fundamentally different plans of one fare vs. fare zones. The influences are exactly opposed —one centrifugal, the other centripetal. The flat fare encourages home building in the suburbs; the zone fare forces tenement building in the close-in districts, which become more and more congested with growth. The one brings a railway system face to face with the embarrassing problem of curtailing over-development desired by greedy landowners; the other brings its problems of development of trunk line capacity to keep pace with the increasing density. Thus the whole problem of city expansion is one of intense social and political interest (in the broader sense), as well as a physical problem, and the author is not wise enough (or foolish enough) to attempt a prediction which will become the established future public policy.

Fare Zones vs. Zone Service: Unquestionably a fare zone has the effect of placing a strong rubber band around the district in question, always urging dwellers toward the center, and from this point of view it would be considered the last resort. However, one hopeful principle seems to have received relatively little consideration in the development of American cities, viz., the organization of zone service according to the density, by which service will be tapered off as the population density decreases, exactly on the plan expressed in the Kelvin Law of electrical copper distribution, wherein the total copper section of feeder cables decreases as the distribution radius from the power plant increases. Here is an exact analogy, which could be applied to any large transit system to bring about substantially the financial result of fare zones, and without discrimination against the suburban home builder. But, unfortunately, local selfishness has generally resulted in opposition to this plan by the suburban wards.

Topography and Contour Plan: The case of San Francisco, already cited, displays an almost unbelievable profundity of ignorance of a proper city plan, which has rendered the problem of efficient, coördinated transit service almost impossible to solve. With numerous hills and eminences rising from 300 to 1,000 feet above the bay, generally the rectangular city plan of San Francisco absolutely disregards the rugged topography, whereas a contour plan could have been developed that would make the city one of the most beautiful in the world. It is said that in the early mining days, when San Francisco was only rocks and sand dunes, an office clerk made the first pencil sketch of the city, with no exact knowledge of the physical situation, and with only the incipient highway, Market Street, to work from as a base line. That was 70 years ago, and perhaps excusable.

But again the city arose from its ruins on *exactly* the straight lines of the old sketch, without a single change or improvement. The responsibility must be laid at the door of political expediency and public torpor. Even with the assiduous efforts of high-minded business men, it was impossible to incorporate even the smallest portion of the splendid city plan just previously completed by Daniel H. Burnham and his staff, who had visioned a new city from their workshop, high up on the slopes of the sunset hills, Today transportation is chaotic in San Francisco, with the original transportation system a mixture of old and new—cable and electric—and steadily approaching financial extinction, and with the new municipal system struggling with its problems of economy against the pressure of the citizens toward over-expansion.

Many cities are wrestling with the same problems of a grossly improper city plan and the utter lack of understanding on the part of the citizens of the great necessity of improving the city plan with the utmost speed, so as to be prepared for the demands of the future. The responsibility largely rests upon the people, and directly upon their elected representatives, to prepare for the future, and not pass on, as they have received, a legacy of inefficient and improper civic development. The City of Pittsburgh is another example of the city developed along "cow paths," yet much more efficient in its street plan than man-made San Francisco. Thus it may be said with truth that no greater service could be rendered by the technical profession than to support the agencies created for the conservation of civic development and with group action, as well as individual action.

In Chicago the way is plain, in fact this city is infinitely favored with respect to topography. But there still remains the problem of the water courses through the city, which imposes an artificial elevation of streets throughout their length, which sooner or later will be marked by fixed bridges and regraded streets, starting with the downtown districts and gradually extending outward as the city develops. If Chicago, with its freedom from traditional blunders of the past, is unable to solve the technical problems correctly, what should we expect of less favored cities, broken by hills, ravines, and precipices, or of those whose very life and safety depend upon the permanence of the flood levees surrounding them, such as New Orleans and Sacramento?

Waste Spaces: In every city, waste spaces are ultimately turned into home lands, industrial sites, or pleasure grounds. The demand will come sooner or later. Therefore how important to plan ahead of time for correct development, so that new cities may rise from bogs, dumping grounds, and goat pastures, with the elements of a proper city transit plan always in view. Thus has San Francisco converted its bare sunset dunes into parks and stately homesteads, and its north coast into the most remarkable civic exposition the world has ever seen; Syracuse its salt marshes into barge terminals and industrial sites; New Orleans its riparian "batture" into a site for one of the world's largest cotton and grain warehouse terminals. And so Chicago will gradually reclaim its remaining low lands, for history reveals the fact that Chicago was literally "jacked up" out of the swamps. Such opportunities exist in every city, but they must be planned beforehand. Later the cost of replanning may become prohibitive.

General City Plan: To conceive in all its future greatness and beauty the basic plan of a great city is indeed a task worthy of the highest abilities of man; to vision a future city, its distribution of peoples, its street system, its home lands, its industries, railroads, waterways, docks, and all the necessary utilities, its public places, parks, playgrounds, educational and sanitary institutions, its hallowed places, its monuments, historical relics and decorative features, and, above all, to interpret in material form that precise individual, aesthetic quality which characterizes the pleasing cities as distinct from crude, repulsive expediency of purely industrial cities—this is the meaning of a true City Plan. We may not dwell upon this subject further than to recall the work of Sir Christopher Wren, the planner of London; Baron Haussman, of Paris; Major L'Enfant, of Washington; Daniel H. Burnham, of Chicago, and more recently the work of numerous skilled artisans in this field, who have set before the people of our cities a vision of their future greatness, such as San Francisco, Pittsburgh, Quebec, Brooklyn, Akron, Reading, Harrisburg, and many others.

In this paper only the general street plan as related to transportation will be discussed, in so far as it involves essential traffic thoroughfares, grade separation, etc.

But, in passing, it is important that we should not forget that a City Plan is just pretty paper if the enlightened citizens do not get behind it with all the moral forces of their community life, to solve the vastly complex problems of legislation, political obstruction, local jealousies, and last, but not least, general indifference. The promotional work of the Chicago Plan Commission stands out in bright relief in constantly keeping the plan of Chicago before the public eye, and in fostering, "step by step," the most important elements of that plan as fast as public opinion is able to digest them, such as the Twelfth Street widening, Michigan Avenue improvement, South Water Street improvement, the Lake Front terminal plan, the Ogden Avenue extension, etc. And no better idea of the tremendous play of forces and difficulties of making progress under our democratic form of government can be obtained than in Walter D. Moody's recital of the Chicago Plan, "What of the City?" Paris was redesigned by imperial decree, to the everlasting credit of French concepts of pure beauty as well as efficiency. Sir Christopher Wren's plan was turned down. What shall we do with ours?

Zoning and Stability in Values: The comparatively recent movement in American cities advocating an inefficient zoning of cities has been greatly intensified by the widespread shortage of housing facilities, brought about by cessation of building during the war, and no better evidence can be cited of the unalterable power of civic growth when artificially arrested than by this tremendous demand. But it is opportune in one respect that this temporary shortage has occurred, because of the unusual chance afforded to correct past errors in the City Plan. The effect of comprehensive zoning, promptly applied, will be felt for all time to come, in securing the foundations of a transportation plan which can reasonably be settled now with respect to its basic parts, leaving the less essential details for future development.

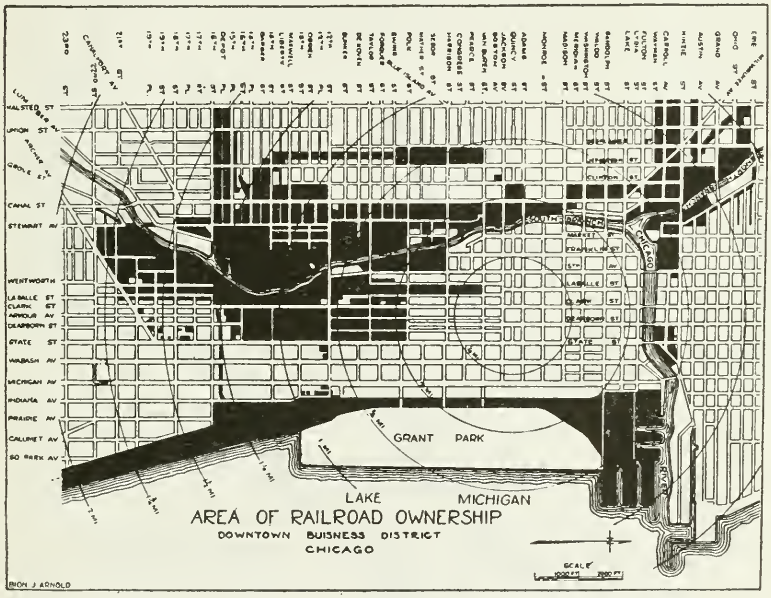
But the most important effect, perhaps, will be in stabilizing and conserving realty values, which in the last analysis form the foundation of civic prosperity. It is possible to plan efficient transportation for a stable city; uncertainty and change, on the other hand, inject elements of risk which only too often result in the dissipation of investment in transportation properties brought about by these changes. The risk is always expensive and the people must always bear the load. The zoning plan and the street plan are therefore a foundation of any comprehensive plan worthy of the name.

Intensive Development: Finally, the physical plan of the city is certain to be modified with time, unless intensive development is resorted to, especially in the congested business and railroad districts. No better example can be offered than the Park Avenue development in the vicinity of Grand Central Station, New York, where enormous values have been created out of good planning, simply by intensive development of both "sub-surface" and "air rights" in a district which strategically is fixed and cannot be expanded except in a vertical direction. Every large, growing city will face the same problem sooner or later. The West Side railroads of Chicago were fortunately prevailed upon to double-deck their facilities along the river, and later the railroad district east of the river must reasonably conform to some such plan as has been worked out in substantial detail by the Chicago Plan Commission, the Western Indiana Railroad, and others.

In the development of realty there is a reasonably precise economic law between the value of land and of the improvements thereon. This law will prevail ultimately in the case of railroad areas and inefficiently used property of the commercial districts. Otherwise it will be impossible for transportation facilities to keep pace with the demands of city growth. In a large measure the railroad facilities in downtown Chicago reflect standards of the past, while the city is struggling upward with its intense problems of the present. This will be brought to mind forcibly by the fact that in the downtown district of Chicago more than half of the area is occupied by railroad properties, and less than half available for public business. In predicting that this condition cannot last, there is no thought of dispossession, but, rather, that by intensive development both railroad and public buisness can be properly cared for and tremendously expanded.

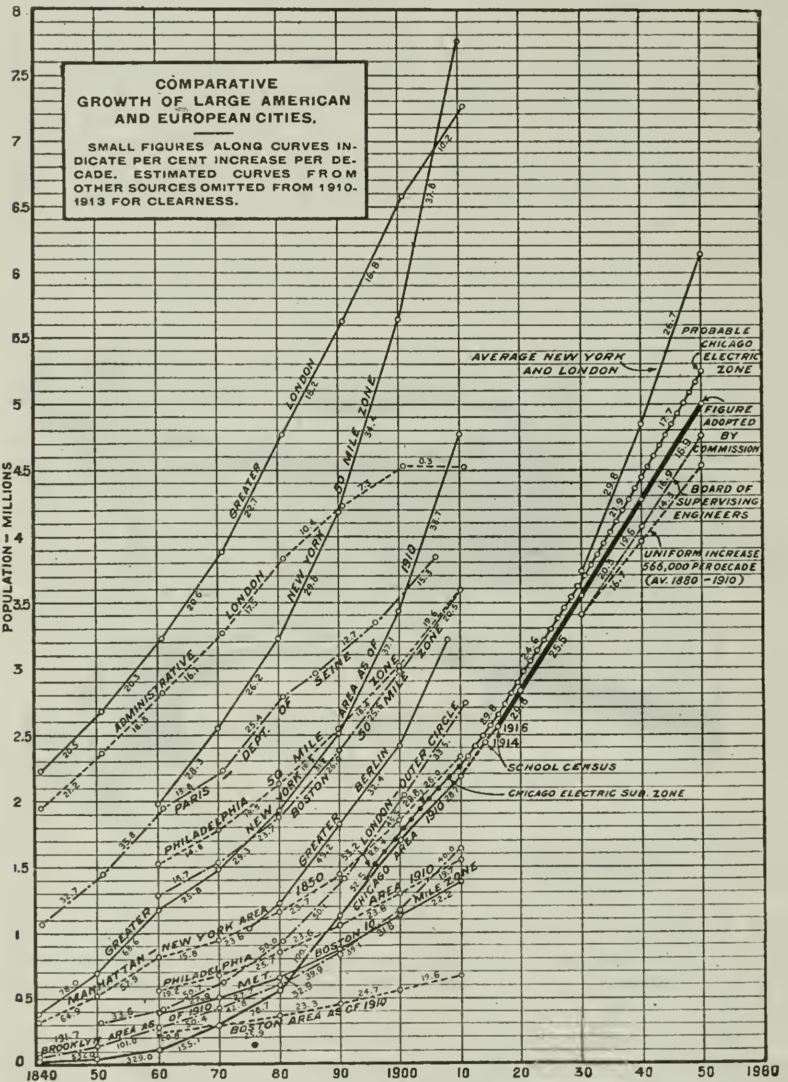
II. FUTURE LAYOUT PLANS—THE MENACE OF FUTURE GROWTH.

Population and Density: The desire for mere bigness in population and wealth of a city may become an unwholesome aspiration and a serious menace if not accompanied by skilled planning and efficient administration and wholesome civic spirit. While some cities have profited extensively by their strategic economic situation, such as Chicago, a general law of increase prevails in all cities, with local variations. Thus urban population is found to double in from one to three or four decades in the majority of active, well-situated cities. Assuming 25 per cent increase per decade, it is easy to see that within our lifetime the city must provide for double its present population. This increase can only be absorbed through increasing density, or extension of the city limits to prevent over-density. For comfortable, individual housing a certain density must not be exceeded; for tenements (apartment houses) three stories is about the limit for healthful community life. Yet in the great American metropolis, in the tenement district of the lower East Side, where Leon Trotsky and his kind flourish, is permitted a density exceeding 1,000 per acre. Here is the menace of future growth. With intelligent and efficient city building and adequate transportation the menace can be avoided.



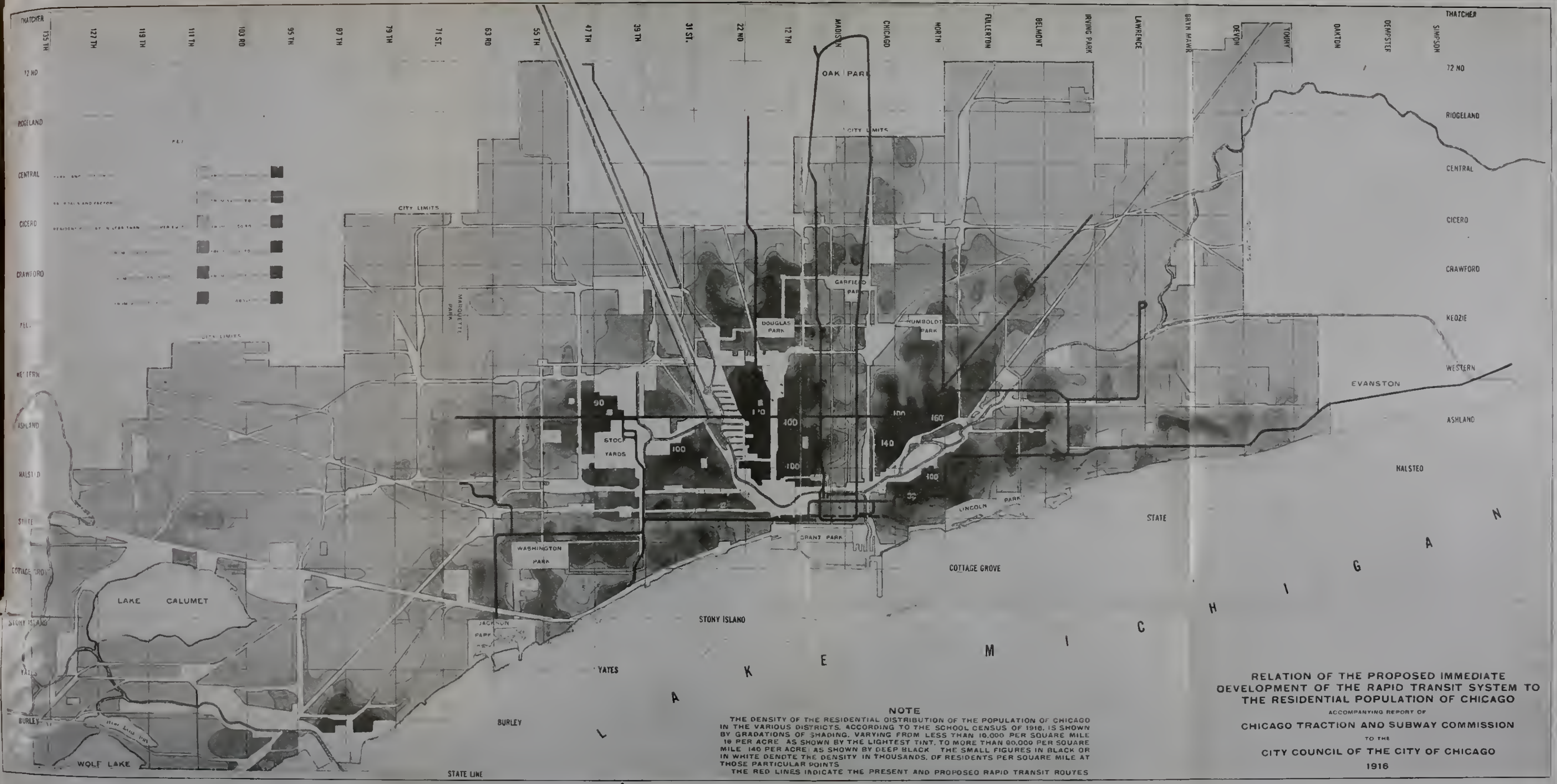
The Iron Band and the Chinese Wall, a necessity and yet a menace. What shall we do with it—expand horizontally or vertically? (c)

Motor Vehicle Traffic: The previous generation may be excused for not being able to anticipate the tremendous growth of motor vehicles in America. Today the provision for automobile transportation has become one of the most pressing needs of all cities. In Chicago there are today about 100,000 automobiles, the number having doubled in four to five years. Yet, with the exception of a few overloaded boulevards, all of them far too narrow for even present purposes, there are no specific motor routes in our City Plan and no suitable provision for parking the fleet of gas-driven machines city-bound. The 1917 vehicle count of Chicago's Loop district showed over 50,000 machines



The Urge of the City. A forecast and its realization (1920, Chicago). What shall we do with 5,000,000 people? (Note the continued growth of greater cities practically due to outer districts.) (a)

entering the Loop, and the maximum hourly rate far greater. The problem of street capacity, traffic obstructions, and crossing delays has already rendered these entrance boulevards almost impassable



NOTE

THE DENSITY OF THE RESIDENTIAL DISTRIBUTION OF THE POPULATION OF CHICAGO IN THE VARIOUS DISTRICTS, ACCORDING TO THE SCHOOL CENSUS OF 1916, IS SHOWN BY GRADATIONS OF SHADING, VARYING FROM LESS THAN 10,000 PER SQUARE MILE 16 PER ACRE AS SHOWN BY THE LIGHTEST TINT, TO MORE THAN 90,000 PER SQUARE MILE 140 PER ACRE) AS SHOWN BY DEEP BLACK THE SMALL FIGURES IN BLACK OR IN WHITE DENOTE THE DENSITY IN THOUSANDS, OF RESIDENTS PER SQUARE MILE AT THOSE PARTICULAR POINTS

THE RED LINES INDICATE THE PRESENT AND PROPOSED RAPID TRANSIT ROUTES

RELATION OF THE PROPOSED IMMEDIATE DEVELOPMENT OF THE RAPID TRANSIT SYSTEM TO THE RESIDENTIAL POPULATION OF CHICAGO

ACCOMPANYING REPORT OF

CHICAGO TRACTION AND SUBWAY COMMISSION

TO THE

CITY COUNCIL OF THE CITY OF CHICAGO

1916

Where Do the People Live? City areas and densities have little relation. Note the location of the mountain peaks and their proximity to industrial and railroad areas. Also the tremendous areas open for settlement, with proper transportation—plenty of room for all. (a)

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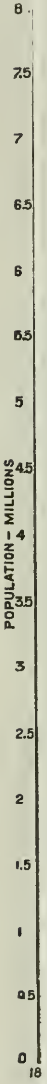

shall
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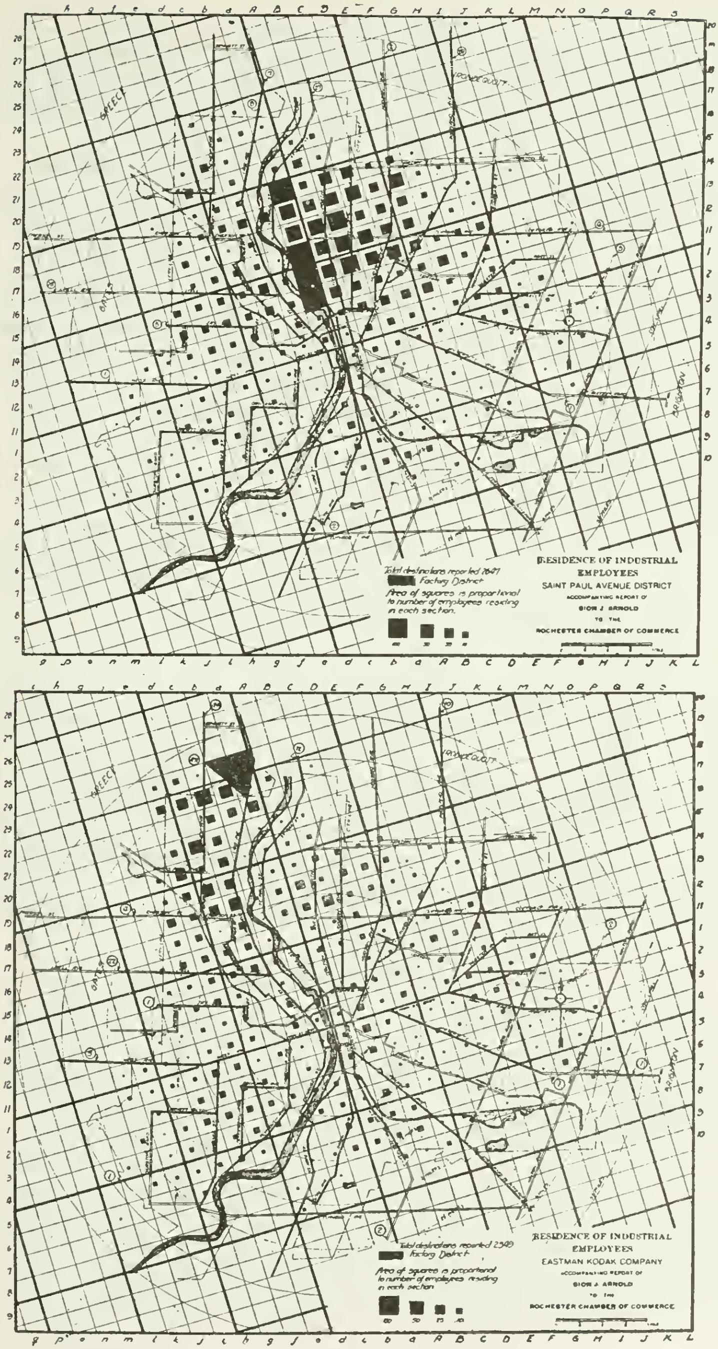
entering the Loop, and the maximum hourly rate far greater. The problem of street capacity, traffic obstructions, and crossing delays has already rendered these entrance boulevards almost impassable


GREECE
IRONDEQUOIT
GATES
BRIGHTON
Total destinations reported 7647
Factory District
Area of squares is proportional to number of employees residing in each section.
RESIDENCE OF INDUSTRIAL EMPLOYEES
SAINT PAUL AVENUE DISTRICT
ACCOMPANYING REPORT OF
BION J. ARNOLD
TO THE
ROCHESTER CHAMBER OF COMMERCE
Total destinations reported 2549
Factory District
Area of squares is proportional to number of employees residing in each section
RESIDENCE OF INDUSTRIAL EMPLOYEES
EASTMAN KODAK COMPANY
ACCOMPANYING REPORT OF
BION J. ARNOLD
TO THE
ROCHESTER CHAMBER OF COMMERCE

Where Do the People Work? A new kind of traffic survey yielding origin and destination graphically. How fully are most people dependent upon transportation in order to live away from factory districts? Here crosstown lines are obvious, conspicuous by their absence (see Fig. 10). (d) at rush periods, to say nothing of the intense discomfort due to the volumes of partially burned gas and oil from the machines. A continuance of this condition indeed bids fair to give rise to a new industrial disease with which city dwellers will become afflicted, due to gas poisoning.

Even today a five-minute stoppage of traffic regulation at heavy street intersections produces a cumulative car congestion reaching back for miles and requiring hours of incessant work to clear up. In New York the automobile traffic of Fifth Avenue has brought about a positive block signal operation, by which four or five blocks of vehicles are moved at one signal, and transverse movement absolutely cut off during the period. A traffic tunnel under the Hudson River is now under consideration, which bids fair to handle a vast motor traffic; but neither in New York, nor especially in New Jersey, is any adequate consideration being given to the problem of street capacity for handling the tremendous traffic debouching from either portal.

This phase of the transportation problem, therefore, is one of the greatest importance, and in Chicago it has at last been recognized in the double-decking of the Michigan Avenue improvement and in the complete separation of upper level bridge traffic and lower level trucking traffic in the great South Water Street improvement, now under way.

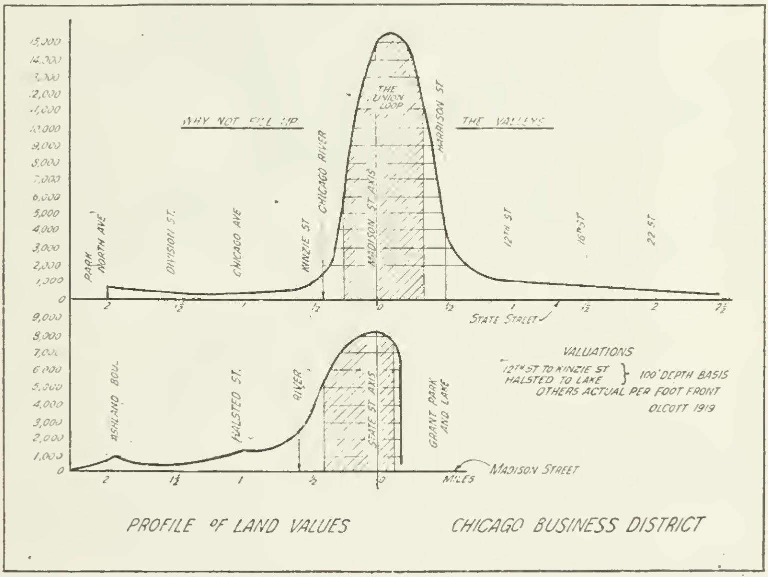
Industrial Areas: General city commerce, as determined by various indices, usually has doubled its operations in thriving cities in about eight years, ranging in most cases from 5 to 13 years. Assuming business to double each decade, how shall industry find the necessary space for corresponding growth? Old Chicago, like Pittsburgh and other industrial cities, found its industries closely grouped around its business center, but one by one the larger industries have had to move out, which always occurs when working conditions become too concentrated. In spite of the loud complaints of downtown merchants, this is one of the most hopeful signs of a greater and better city.

There are obviously only two alternatives: Either new outlying industrial sub-centers must be established, or the industries must move to other smaller cities. Thus the Jones & Laughlin steel plants in Pittsburgh have moved down the Ohio River, and in Chicago the Western Electric Co., Sears, Roebuck & Co., and others have established new centers of community life in the broad acres of the city's suburbs. This fact was illustrated in the industrial survey of the Chicago Traction and Subway Commission, in which the home and place of business of 350,000 industrial workers were determined by canvass. Thus the future city will be found to consist of outlying centers of activity interspersed with housing areas, and all interconnected by efficient rapid transit according to the needs, and all tributary, except for local necessities, to the great downtown district.

Land Values and the Bonding Power: The menace of future growth exists, but, lest anyone should become pessimistic as to the ability of the City to meet this growth properly, let it be said that there exists another unalterable law which, under efficient administration, should provide for the increasing needs of the population. For growth means increased taxable land values, and the purchasing or bonding power of a city is dependent thereon. An analysis of a number of cities revealed to the author the general law that the basic land value increases as about the 1.7 power of the population, varying from 1.5 to 2.0 power.[7] This means that as the population doubles the city should be justified in bonding itself for public improvements at least three or four times to maintain the same bonded debt per capita. Thus the unalterable law of growth is not without its advantages.

III. THE ADMINISTRATIVE BUSINESS CENTER.

Every city must have a business center, around which are grouped the major community activities. It is an illuminating fact that in the 15 largest American cities the business district is adjacent to water courses, which throws into contrast the essential nature of early water transportation. But with the development of land transportation, outlying sub-centers have developed as one of the means of relief to over-congestion and the only rea-



The Andes of Reality. This hump goes up with building heights and terminal congestion. Why not at least fill up the valleys? Should a city of 200 sq. miles concentrate its business within half a mile radius of the center?

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[7] The Arnold Reports on Pittsburgh and San Francisco.

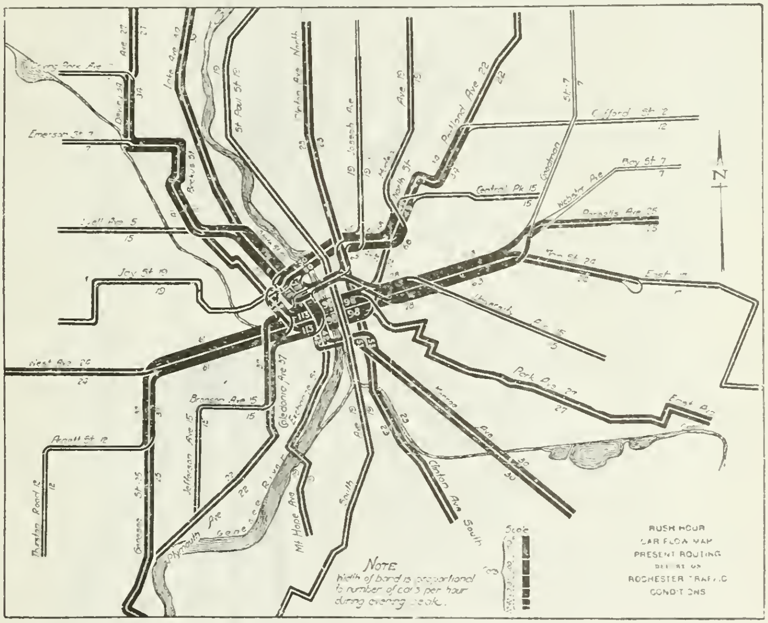
sonable avenue to greater expansion, not only as related to the convenience of the people themselves, but also as to the possibility of serving them with adequate transportation at reasonably low cost. For these sub-centers introduce an increased diversity of traffic or riding habit, which generally secures the possibility of financial success in transportation enterprises, private or public. Thus the Wilson Avenue district, Chicago, developing around the original terminus of the Northwestern elevated, furnishes a most excellent example; also East Liberty, Pittsburgh.

Natural and Artificial Barriers: Transportation offers the only means of breaking down natural physical barriers to the logical expansion of a business district, such as rivers and hills, and it must also be resorted to in counteracting the effects of artificial barriers. Chicago's Chinese wall in the railroad occupation north, west and south can and will be eventually bridged by business expansion through transportation. But a far more subtle condition exists in the play of individual and group forces represented by the merchants favored with downtown location as distinct from those less favored in the close-in districts on the other side of the wall. A profile of land values constructed along the business axis of any city will illustrate the point. Thus in Chicago the Loop values are 16 to 25 times those prevailing outside of the loop along the same thoroughfare about one mile distant from the center. The author will not attempt to argue whether the economic effect of the elevated Loop or the existence of a favored merchant class is responsible for the sudden drop in values outside of the Loop. It suffices to say that any intelligent recommendation for future Chicago cannot fail to consider and incorporate in the City and Transportation Plans some means for releasing artificial barriers now thrown about the business district, to enable it to expand logically in all directions.

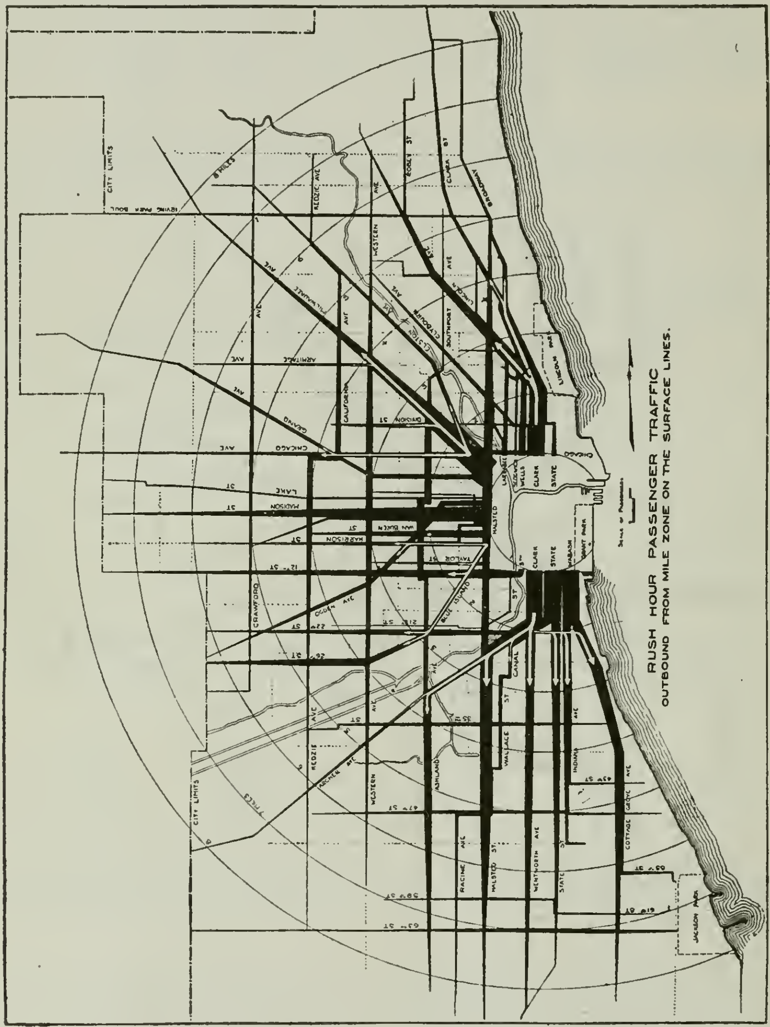
In spite of technical objections, true in themselves, but capable of correction with proper co-operation of the authorities, the greatest hope lies in the establishment of through routes or overlapping routes, by means of which the congested business district will cease to become the terminal excepting perhaps only for the traffic which is destined therein and not beyond. This applies to every city and it is a curious commentary upon the times that so many objections are often raised, to the establishment of these through routes. Dozens of smaller cities and some of the larger ones have worked out this through-routing problem satisfactorily. The point involved is the supposed increased length of haul on through routes. But as already pointed out, Chicago's longest through route has a shorter average haul than any of the equivalent routes terminating in the business district.

Street Capacity and Building Heights: The physical capacity of streets is not, as generally supposed, unlimited. On the contrary, it is capable of fairly definite computation. Unfortunately, downtown streets in most cities are established and can never be changed without prohibitive cost. The only alternative is double-decking. Thus the New York subways transport daily hundreds of thousands of riders who never see the light of day except in their homes and offices. A modern skyscraper houses as many people as most towns and small cities, yet the street capacity is the same as established by the Dutch traders in old New Amsterdam. Recently the garment trade employers wanted to erect two 20-story factory buildings each housing perhaps 15,000 workers; but the new zoning law prevailed.

Again the strong play of forces exists between those who appreciate the menace of increasing congestion and land owners who desire to realize more profit on their investment by restricting the business district and carrying their buildings skyward. Subway transportation can only be a partial and increasingly imperfect solution and it stands to the credit of Chicago that the city was able to restrict its building height until only recently broken down. Even neglecting the fact that in a 20-story developed office district perhaps only half of the occupants are able to do business without artificial lighting, we must still look to subway transportation to meet the problem of future street capacity possibly supplemented by elevated pedestrian roadways on the three-level plan. There is no other alternative, and even New York, with all its subways, has



Are Through Routes Practicable? As a mechanical expedient, many cities would be helpless without them. Here is a typical system, its principal defect being lack of outlying crosstown routes, especially across the Genessee River gorge. (d) witnessed its business district move north until Times Square rather than the City Hall, has become the strategic center. Cleveland, with its magnificent Public Square is in the same state of flux, with business rapidly moving out Euclid Ave. Pittsburgh is hopelessly confined by geographic barriers and must move across the river to Allegheny.



The Daily Rush-Hour Movement. Note the effectiveness of the gridiron plan of crosstown lines in Chicago, applicable to other cities as well. What would we do with only radial feeders? Illustrating the principle that car service should be tapered off with the traffic—zone service rather than zone fares. (e)

From the above it is evident that the greatest function of transportation will be that of centrifugal action to counteract the centripetal tendency of long-established precedent.

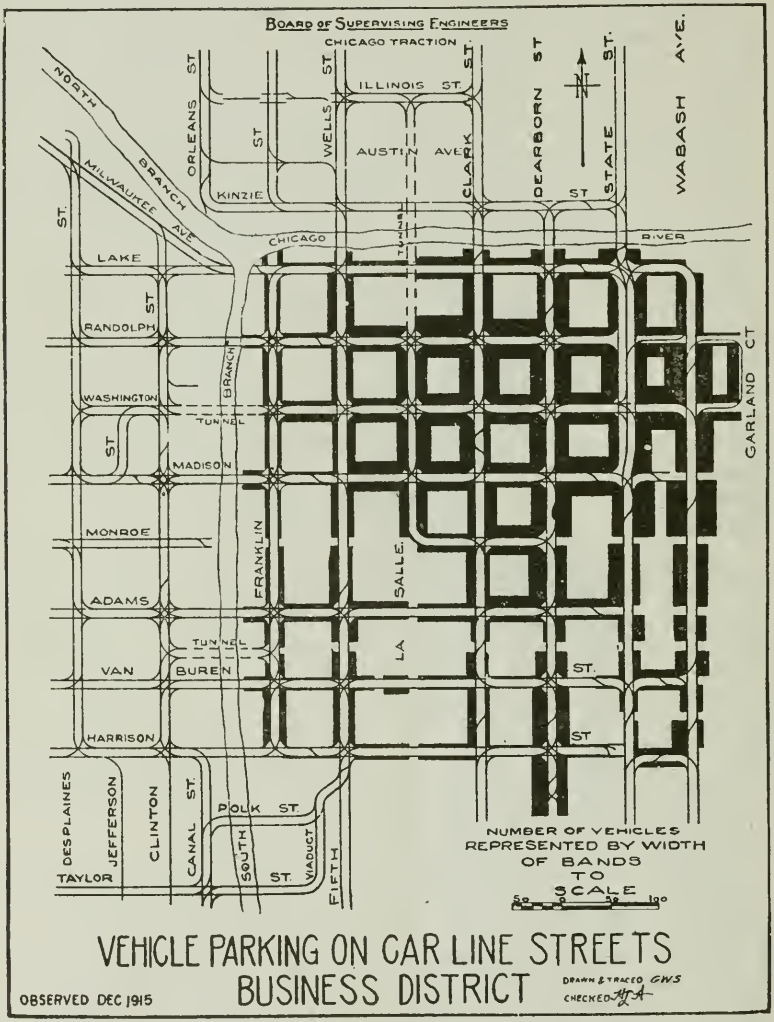
IV. MEANS OF INTERCOMMUNICATION.—THE GENERAL STREET PLAN.

The daily movement of the population within the city portals may be likened to waves thrown up by a stone cast into a pond of water. These waves move radially like sound and light, and no artificial means can prevent this except through pure obstruction. In the case of Manhattan, the shape of the island naturally favored a rectangular street plan, but in no other large city was this necessary. Yet Chicago's 200 square miles have been laid out substantially on the rectangular plan, with only occasional radials developed from original post roads. The southeastern part of the city is very defective in this regard. These available radials have, it is true, been used to their utmost capacity, but more are necessary and a study of the Plan of Chicago will reveal the wisdom of a complete system of diagonal and crosstown lines such as renders the cities of Paris and Washington so efficient in intercommunication. The problem of financing the cutting of diagonal streets is colossal, as evidenced by the $30,000,000 spent by the City of London in extending High Holborn to the Strand, a distance of about a mile; the Ogden Ave. extension, Chicago, will measure to some extent the grasp of its citizens as to the great need of such diagonals.

On the other hand, many cities will be found laid out entirely on the radial plan, with substantially no lateral or interconnecting thoroughfares. Transportation lines have necessarily followed this plan to such an extent that the business centers are cluttered with crosstown traffic which should find its way from origin to destination without ever reaching the business district. The Plan of Chicago will remedy this if it can be carried out. It should be said that the Chicago Traction Plan ordained in 1907 and as administered by the Traction Board, has made great strides toward cross-connecting various parts of the city. With the development of subcenters this will be more and more important.

Danger of Piece-meal Planning: In many cities may be found astonishing examples of short-sighted piece-meal planning in regard to the street plan in which local subdivisions over large areas have been made without the slightest regard to the relation of these subdivisions to the surrounding areas, so that no adequate thoroughfare system can be devised to correct this error without excessive reconstruction. Here indeed is a reason for concentrated administrative responsibility in city building.

The Function of Transportation: In view of these conflicting elements and problems, it must be evident that one great remedy stands forth as the last hope in counter-acting deficiencies in the City Plan—namely that of transportation, and in the location of transportation lines, surface, elevated and subway, the maximum skill and judgment is called for to safeguard the needs of the future. In the business district subways obviously hold the greatest and perhaps the only promise, but in the surrounding and outlying districts the elevated system holds even greater advantage, not only with respect to the lower cost but also in healthful travel. Thus it becomes possible through proper planning to bridge the gaps and conform measureably to the natural daily movement of population,



Why We Get Fined for Parking. A survey of Chicago's street conditions prior to prohibition of parking during rush hours; two-thirds of these cars parked over one hour, many of them all day. Over 50,000 automobiles per day have business in the Loop. What shall we do with them? (e) even though it is unfeasible to bring to early fruition the splendid ideas and visions of the city builder.

V. THE TRAFFIC COPS.—STREET TRAFFIC PROBLEMS.

The next matter of importance to the general street plan is the resulting traffic problem, which is bound sooner or later to become crucial; i. e., automobile parking, freight trucking, and street car movement, as well as pedestrian traffic.

The tremendous growth in motor vehicles traffic has already been mentioned. It occurs in every growing city. The Chicago traffic counts of 1917 reveal the fact that the total daily automobile movement in the Loop amounted to practically the same number as the entire number of automobiles registered within the city. Out of the 50,000 autos moving into and out of the Loop per day, a large proportion was destined to the interior of the Loop. Of the Rush Street Bridge traffic, 75 per cent was destined west of State St. And it was also found that 2,900 autos remained in the Loop between 2:00 and 3:00 p. m., or an average of 2,200 for the 24 hours.

Vehicle Parking: An extensive traffic survey conducted by the author for the Board of Supervising Engineers in 1916 revealed unbelievable conditions with which the existing traffic regulations were then unable to cope successfully. Thus over two-thirds of the total vehicles parked within the Loop were found to remain over one hour, many of them all day. The vast majority were parked along car-line streets and without any apparent recognition of the necessity of keeping clear the car-loading berths at the near-side stops of each street crossing. Subsequent ordinances improved this materially, especially during the rush hours.

Thus a great question arises as to the proper disposition of this great fleet of motor vehicles used by persons having business "downtown" and it does not seem an exaggeration that every city must plan automobile storage along the *boundaries* of its congested districts and as close as possible to absorb this growing vehicle congestion. In Chicago, the unusual facilities offered by Grant Park should be developed perhaps as a sub-surface facility. And in the plan of the South Water St. improvement and its possible extension south along the river, further facilities can be made available at extremely reasonably cost, as recently illustrated in the plans developed therefor.[8]

The Right-of-way: Closely associated with the parking problem is that of securing for local transit lines the necessary right-of-way to provide that speed of transit rightly demanded by the citizens. And here is one of the most direct applications of the principle of "greatest good to the greatest number." In 1916, over 50,000,000 people were found to enter and leave the Loop by elevated lines, 83,000,000 by surface lines, or about 133,000,000 total.

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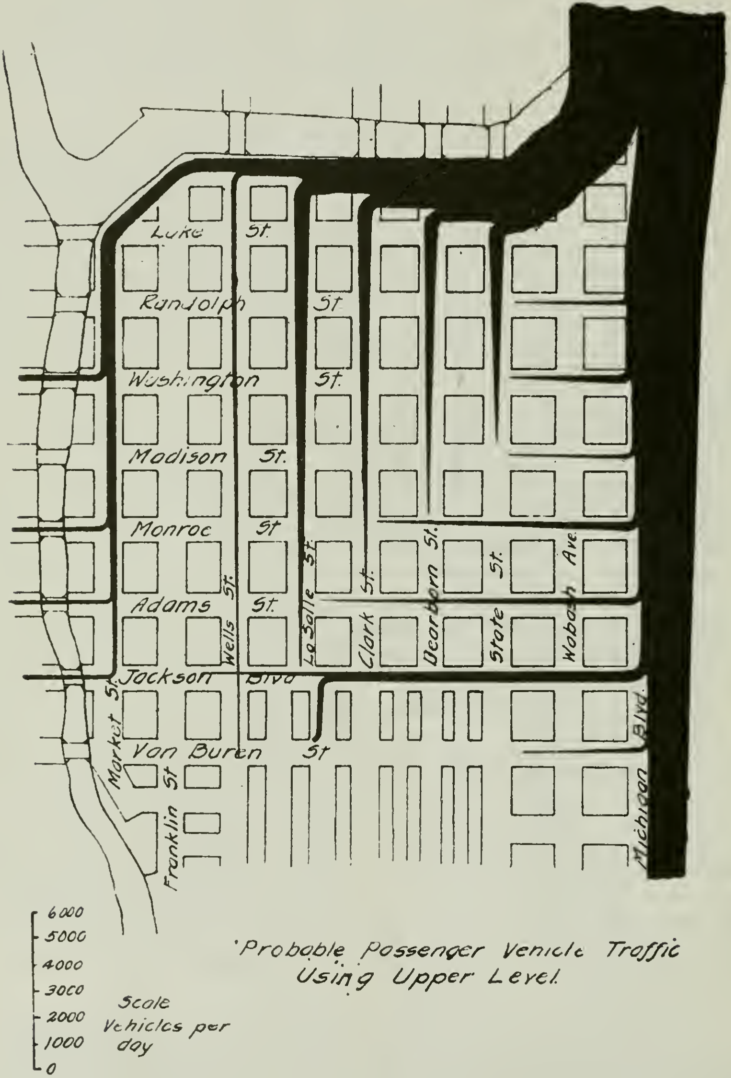
[8] Arnold Report on Transportation Features of the Improvement. 1920.

This amounts to 365,000 passengers per day, or over 13 per cent of the city population. This is nearly one-third of the total daily car traffic throughout the city. As this traffic increases around 8 per cent per year and as all local transportation system focus in the Loop, the total track activity as found in the public streets must reflect a corresponding increase.

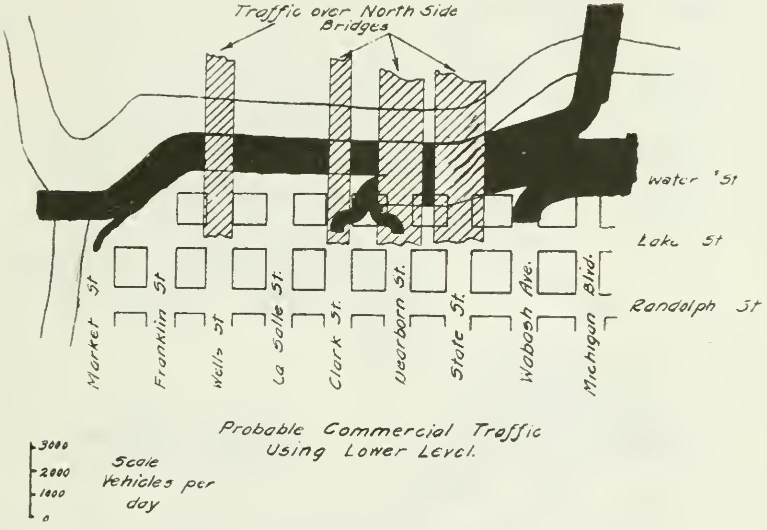


Probable Passenger Vehicle Traffic Using Upper Level.

Based on traffic counts of 1916

Thus it is a foregone conclusion that city dwellers must decide for themselves whether rapid transit for the millions carried on electric lines is of more importance or less importance than the theoretical application of the principle that public streets are for the use of all citizens alike, wherein lies the particular balance of justice as between the obdurate teamster and the hundreds of passengers delayed in the cars behind him.

Street Paving and Maintenance: There is to be said, however, in justification of the teamster's use of the car tracks, that he can hardly be expected to appreciate the necessity of surrendering the right-of-way until the city shall provide street paving properly designed to enable him to use the sideways or else parallel trucking thoroughfares definitely reserved for his use. In the business districts in winter, loaded trucks and horses have been observed to slide off to the curb on icy pavements, due to excessive crowning of the pavement. And improper maintenance often makes it humanly impossible for trucks to leave the car tracks. One remedy is to install flatter paving with additional drainage facilities as on Van Buren Street, Chicago.



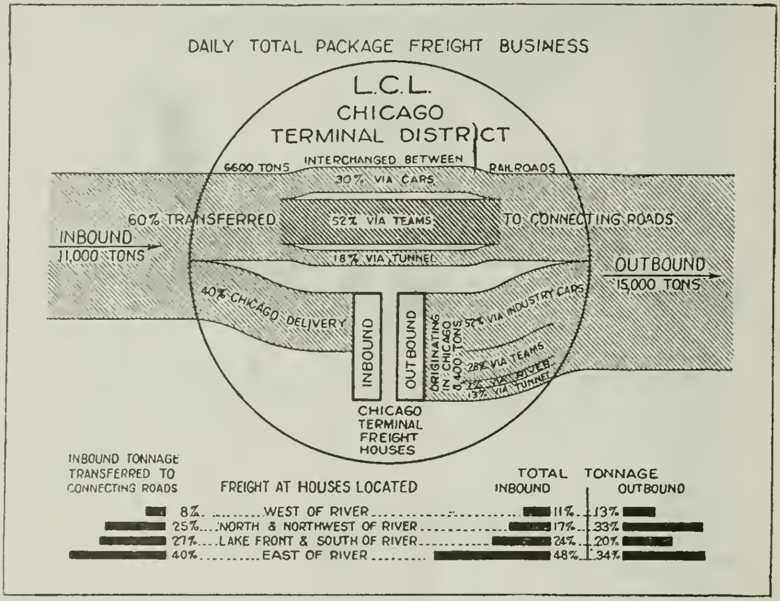
Probable Commercial Traffic Using Lower Level.

Based on traffic counts of 1916.

Lesson (2) in Chicago City Planning. The estimated effect of the South Water Street double-deck improvement applied to 1916 traffic. Two distributing trunks instead of one. Traffic grade separation at the bridges. A by-pass around the Loop. Why not continue it south? (f)

Street Capacity and the Traffic Signal: Few persons realize the immense importance of the traffic signal in increasing speed of traffic movement and promoting the maximum volume of vehicle and car movements. Suffice it to say, that this problem must be worked out scientifically with traffic officers trained to select intuitively the proper duration of signal to bring about this maximum movement. The various factors entering are not in any sense vague or indeterminate, and should be analyzed for each important intersection, as was done in the case of the Chicago survey.[9]

Freight Trucking: Here is an added complication, especially in cities whose business centers are held within the iron band of



Freight Transfer and City Streets. 3,400 tons trucked through the office and commercial district; not one ton had any business there. There are 65 miles of freight tunnel beneath the streets only partially used. Why not develop it fully? (c)

railroad operations, as in Chicago. A former terminal survey showed that 52 per cent of the l. c. l. (less-than-carload-lots) interchange between downtown freight houses originating at or destined to points outside of Chicago, was teamed through downtown city streets, this traffic being superimposed on the local passenger and business traffic, not only through the day but also unfortunately during the rush hours.[10] The balance was transferred by other means, 30 per cent by railroad trap cars and 18 per cent by the Chicago freight tunnel. Thus of the total movement of 6,600 tons per day, which had no business in the congested district, over 3,400 tons used the business streets. The tonnage has since increased

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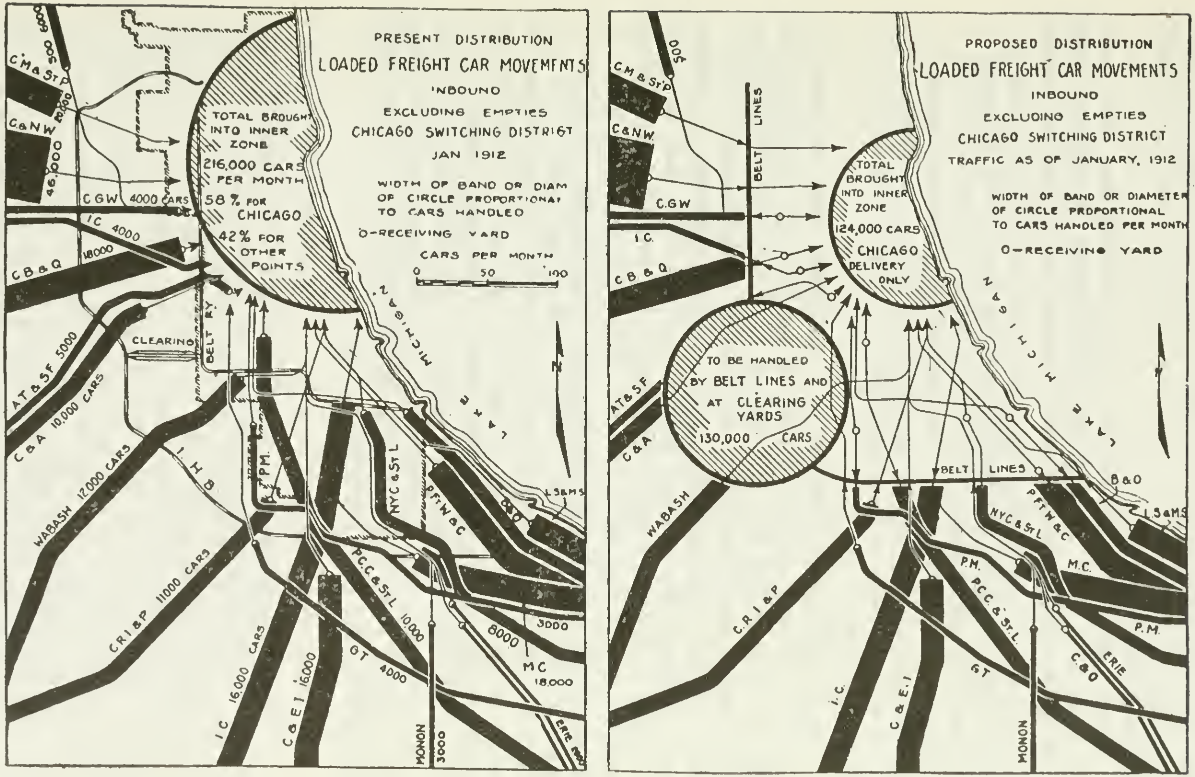
[9] Report on Investigation of Traffic Conditions and Track Capacity, Board of Supervising Engineers, 1916.

[10] Arnold Report on Railroad Terminals to Citizens' Terminal Plan Committee, 1913.



Clearing, Before and After 40 roads operate in Chicago. It is fortunate that Clearing is established, with a capacity of 10,000 cars per day. A real by-pass route around Chicago gateway. This applies to other centers. (c) though a corresponding increase in street trucking traffic may have been retarded by the terminal measures enforced by the U. S. Railroad Administration in passing some of this l. c. l. traffic around Chicago by "making up" at points in the back country, the main problem is still unsolved.

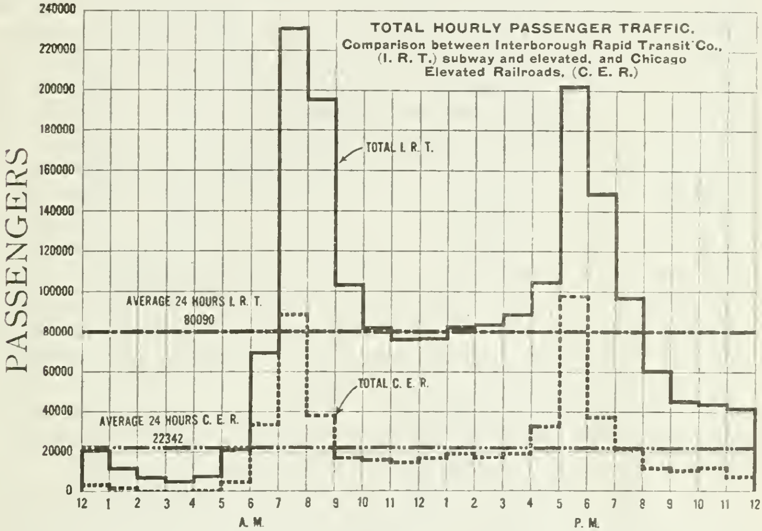
Trap Cars vs. Motor Trucks: Quite recently the "unit-package" plan of l. c. l. freight transfer has been developed, using 2-5 ton motor trucks designed with standard interchangeable bodies. On this plan, the relatively expensive chassis and crew may be kept busier, while the body containers are being loaded and unloaded at the most convenient times. Freight house platforms are being so designed as to facilitate this movement with service cranes, etc. It is even proposed to handle the package business now done in trap cars so as to release railroad facilities for originating and destined business entirely.

While undoubtedly efficient as a temporary local expedient in view of the *present* congested railroad facilities, we should not lose sight of the fact that the ultimate use of this system will bring an added burden upon the public streets which must be met by provision of separate traffic ways for this freight movement as distinct from passenger and general business movement. And in return the motor transport system should support a proper charge for the intensive use of the public streets. This might be done by a system of traffic assessments proportioned to the size, weight and density of movement. But, unless separate traffic ways are provided, it is inconceivable that railroad trap-car business should be transferred to the public streets and the maintenance thereof levied upon the city through general taxation. This only emphasizes the need of careful planning. In Chicago, a good start has been made in the two-level traffic segregation of the Michigan Ave. and South Water Street improvements, although no provision has been made for apportioning the maintenance cost.

VI. THE OPERATING DEPARTMENT.—RUSH-HOUR PROBLEMS.

It is no exaggeration to say that urban transportation would present no serious problems, technical or financial, if there were no rush hours, or even if it were possible for concentrated industries, such as office buildings and large factories, to agree upon a system of staggered hours of employment for the benefit of the general riding public, and if the non-rush travel could be encouraged to use non-rush hours. There are so many factors involved that it is impossible to do more than touch on them here; the capacity of the street plan and the characteristics of street and trucking traffic have already been mentioned. Superimpose upon this a rush passenger traffic during the four-hour rush periods, amounting to from 20 to 40 per cent of the total daily movement, and one may obtain a good perspective of the problem of adequate rush hour transportation.[11] Steam suburban service can never handle but a comparatively small proportion of the total, necessarily long distance riders. Private automobiles, in spite of their great number, are extremely limited in their capacity; jitney service is limited for the same reason.

The fact remains that the street railways, and in the larger cities, the rapid transit lines, must be depended upon to do the great volume of transportation work. In New York, the rapid transit traffic predominates, due largely to strategic position. In Chicago, the position is reversed and the surface lines handle about two-thirds of the total business. This condition will of course reverse, as Chicago's population increases and rapid transit movement becomes imperative.



The Habits of the Free American. Travels at the peak, so a transportation system must be designed to handle these peak loads. Illustrating the cost of non-rush idleness. (a)

Habits of the Free American: How much the American mode of life differs from the European is evidenced in the refusal of the American public to accept limitation of car loading. In Europe, the "Car full" or "Complet" sign is proverbial, by means of which, if a car is fully loaded, the passenger must wait until the cars are less crowded. In America, while sporadic attempts have been made to adopt this plan, it has generally been violently opposed and where installed, generously overlooked. Therefore, this American characteristic means that the engineer must design the transportation plan to meet as nearly as possible these tremendous peak loads of city travel. In most large transit systems, the maximum hours traffic ranges from 200 to 400 per cent of the normal base day traffic, and the maximum 20 or 30 minute rush movement is much greater. The corresponding maximum movement on rapid transit line in New York and Chicago amounts to from 300 to 500 per cent of the base day traffic. Imagine the congestion of city streets if sufficient cars were operated to meet this proportionate demand with a seated load.

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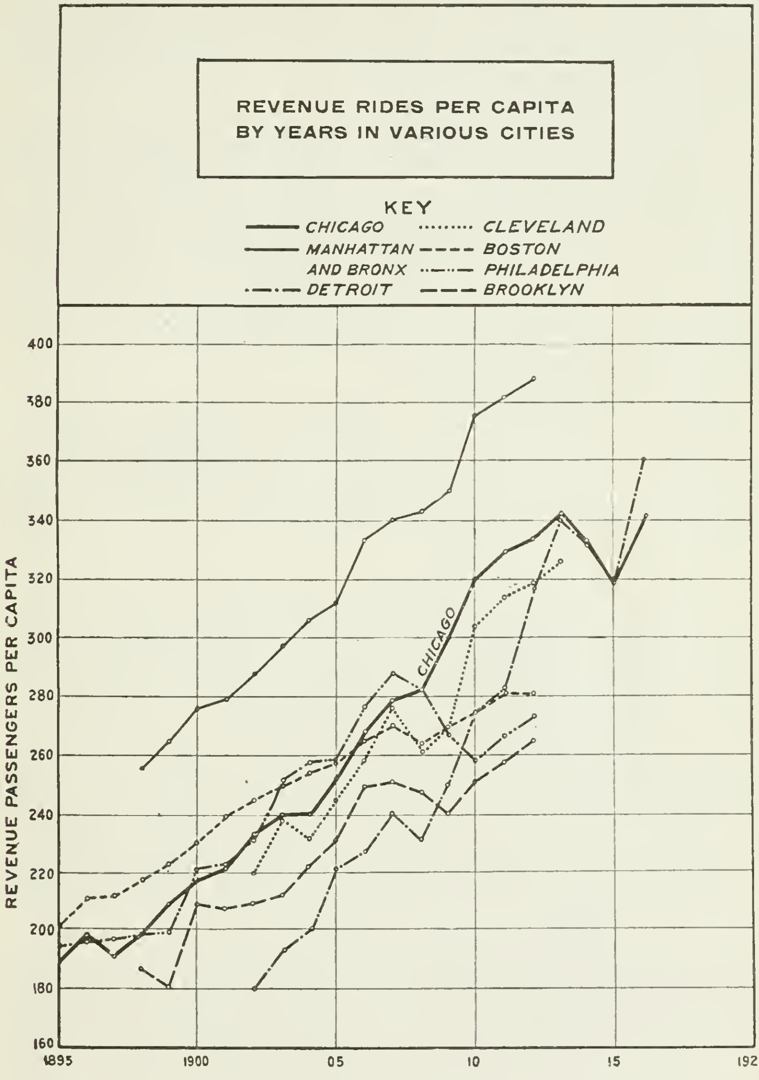
[11] Chicago Elevated Loop traffic for one-hour rush, morning and evening, amounts to 30 per cent of the all-day traffic.

Cost of Service and Service Standards: Every "traction battle" with which American cities are afflicted results at one stage or another in the slogan "Seats for every passenger." How impracticable such a standard must be is well reflected by the present condition of already over-loaded streets. We therefore must accept the inevitable "American plan" of full liberty of action on the part of the passenger until such time as the cities awake to the necessity of providing necessary street and transit capacity. The daily exhibition in the New York subway which is the biggest railroad movement on earth, is a sufficient example; for 10-car trains operating under considerably less than one minute headway, are hopelessly unable to cope with even standing load, regardless of the seated load, this is sufficient evidence of the difficulties confronting every large city of intensely centralized business. On rapid transit lines, the rush hour capacity can most easily be increased by lengthening the train. For surface lines, this is impossible excepting by adding trailers or an upper deck, which are not without their serious limitations. As a result the surface lines usually place in operation the "rush hour trippers" to the extent of from 85 per cent to 100 per cent or more in excess of the base day movement.

In power production, the high cost of providing peak load power as compared with uniform loading, is well known, but the general public seemingly cannot understand that peak load transportation is even more expensive because of the additional number of part-time crews required and the exceeding difficulty in assigning these crews so as to meet the demands of public travel within a reasonable total working day, which involves the "spread" in hours, the most difficult task of the schedule maker especially under the demands of Labor for an eight hour day; for if three shifts were required under prevailing fares rapid transit would ordinarily become financially impossible.

Therefore, to secure a fuller understanding of the true cost of service by the layman, is one of the duties of the engineer, for this is becoming more and more a basis of negotiating new utility franchises and properly so. In the last analysis, it simply expresses the idea of the "pay-down plan" of service, i. e., that a passenger pays in fare what the service actually costs, including proper upkeep of the physical plant and provision for continuous rejuvenation of its various elements when required.

Through Routes and Zone Service: Certain expedients are fortunately available for mitigating the problem of the rush-hour. The first of importance is the operation of through routes, by means of which the congestion and complication of Loop and stub terminals may be largely avoided and the effect of an overlapping down town service gained, which rids the streets of much unnecessary rush pedestrian traffic. In spite of the widespread use of through-routes, some operators still seem to misunderstand their true function.



The Key to Success or Failure. Some people contend for a maximum of 400 rides per capita. What will Chicago's riding habit be with 5,000,000 in 1950; it has already overtaken Greater New York? (a)

The plan is fundamentally one of physical relief from terminal congestion and slowing down of line operation, all of which culminates in decreased carrying capacity and excessive investment. An important function is also to break away from the old iron-bound loop plan, so as to encourage the expansion of the business district and abate what may easily amount to serious discrimination in favor of the "heart of the business district."

Further relief may be obtained by a system of zone-service which has already been mentioned in connection with the long haul lines to the outlying districts—that is, tapering off the service by superimposed short lines to suit the traffic. A similar zoning down town can be used, with short lines or "turn-backs," which do not penetrate the most congested area, but pick up the excess traffic from the boundaries of the district. But this turn-back service has its limitations and can only be used during the densest rush-hour periods due to the difficulty of matching schedules to give reasonably uniform trunk line headway.

Outside of efficient traffic regulation and such other details of car design and operation, such as skip-stops, entrances, seating arrangement, etc., there remain no very great possibilities of relief; then the time has come when cities must adopt bonafide rapid transit plans, first, surface car subways, perhaps, and later standard train subways.

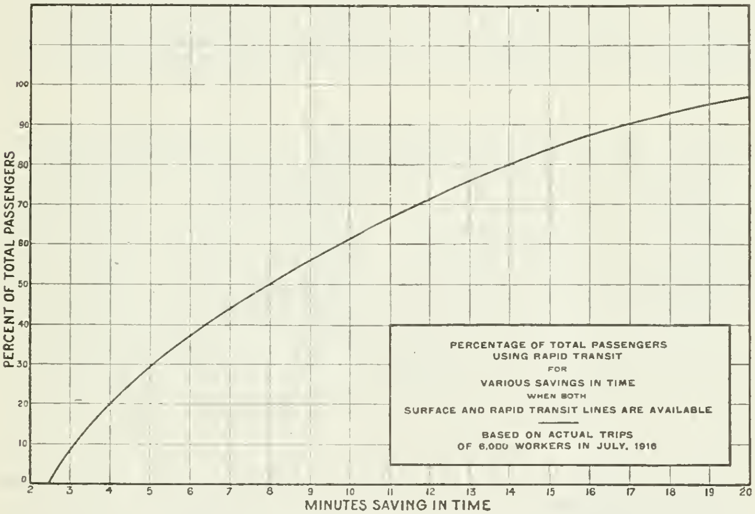
VII. FINANCIAL RESOURCES.—THE RIDING HABIT.

In the mind of the layman, local transportation has long been looked upon as a "gold mine"; but even a gold mine has its limitations. There is, in fact, a curiously definite relation between the population and the amount contributed annually to the support of transit investment and service. In other words, the riding habit determines first and last the possibilities of development because it controls the revenue. This riding habit increases as the city grows and density of settlement increases. The law is complex, but individual cases are usually consistent. Thus the riding habit of a number of the large cities since electric railways came into existence, has steadily increased from around 200 revenue rides per capita to 350 or more; Manhattan Island approaches 400 rides per capita.

If this riding habit continued to increase roughly in proportion to the population, the ultimate traffic volume would eventually become enormous, because of the geometric progression involved. So some authorities claim 400 rides to be a conservative limit, but time alone can tell; it is more than probable that the epoch of electric development has had a controlling effect. The author cannot find indications of any such abrupt cessation.

Expressed in pre-war dollars, the "riding habit" means that in moderate sized cities the people contribute at least $10 per capita per year for local transportation; in the larger cities and in those unusually dependent upon transportation, such as San Francisco, from $15.00 to $20.00 per capita.

An analysis of a large number of these cities revealed the astounding fact that transportation earnings had increased about as the square of the population, which means that when the population doubles, transit earnings quadruple. New York for many decades has held to this law, with occasional variations.[12] But here again, the Epoch of Electricity is involved, and looking into the future, it seems certain that various causes will conspire to moderate this geometric rate of increase, such as periods of financial depression, wars, etc. But the plain fact stands out in every case, that transportation service *must be had*, and this represents an indirect prior tax on the entire community. This is the yard stick by which to measure the financial possibilities of a complete transit system; conversely, any utility expanding beyond the demand for it, is doomed to long years of deficits if not early failure.



Rapid Transit Planning Must Be Conservative. People will not patronize rapid transit lines unless they get MORE RAPID transit. Showing the proportion of probable tributary traffic based on time and convenience. (a)

To this source of income or taxation should be added the suburban railroad fares and the revenues of jitneys and bus lines. Some steam suburban service yields $10 per capita, as in Pittsburgh; this is probably exceeded in New York, Philadelphia and Boston. As the average family consists of 4.5 persons the total tax on the wage earner or head of family may exceed $100 per year.

VIII. THE PLANNING DEPARTMENT.—RAPID TRANSIT DEVELOPMENT.

Interim Measures: It must be obvious from the preceding that sound rapid transit development is subject to decided limitation of revenue, density and other local factors. Primarily, a system ought to be devised which would, when the city has outgrown its surface lines, permit the maximum radius of travel for the least money, such as open cut, or elevated, leaving expensive subways to the future when warranted by increasing density. Unfortunately, the evil day is often put off too long, with the result that a patchwork system has to be used, as in Boston, which made the mistake of considering early street car tunnels as rapid transit subways.

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[12] Arnold Report on Pittsburgh Transportation Problem, 1910.

Obviously this is an error which sometimes can never be corrected because the bore is built too small for ultimate rapid transit train service. However, it sometimes occurs that street car tunnels are of use as *interim measures* due to the increasing car movement through the business district. Detroit, Pittsburgh and Cleveland are in this situation at present and it is improbable that extensive rapid transit lines as such would pay in any of these cities at present. Philadelphia endeavored to keep straight and develop gradually, with reasonable success. New York succumbed to expediency through the tenacious conflict of interests of individual transit corporations, each demanding the right to reach into the other's heavy traffic area.

Standardization: Here indeed is a forceful argument for the adoption of complete standardization as far as possible within a given metropolitan area. For a city to partition its traffic among different interests, or to embark in experimentation on such a large scale that the cost thereof, in case of failure, will be embarrassing, would appear to be the height of civic folly where it is possible to develop along normal logical lines. *Rapid transit must grow with the city and it should start right to secure the best permanent results.*

Chicago fortunately is not handicapped as the older eastern cities by bad precedent or subsurface structures already defective in location or capacity. Chicago has a clean slate, yet it is seemingly difficult for the average citizen to comprehend the rapid transit problem in its most important aspect. Four or five major surveys and reports have already been made and in each case the voting public failed to respond to the necessity; both "initial" and "comprehensive" plans have been turned down at the polls. The surface lines terminals continue grossly inadequate; the elevated system is prevented from further development by the handicap of a two-track terminal loop into which debouches the traffic from 13 feeder tracks; yet substantial progress has been made.

The 1916 Survey: Unusual efforts were made in 1916 to plan a program for Chicago which would appraise at its true value the present density and wide distribution of housing and industries with relation to down town street capacity and the traffic "center of gravity," also the origin and destination of this traffic, so that the mistake of either under or over development would not be made.[13] To this end, the home and place of work of 350,000 office and factory employees was determined, also the origin and destination of 500,000 elevated riders (or 95 per cent of one day's traffic) and

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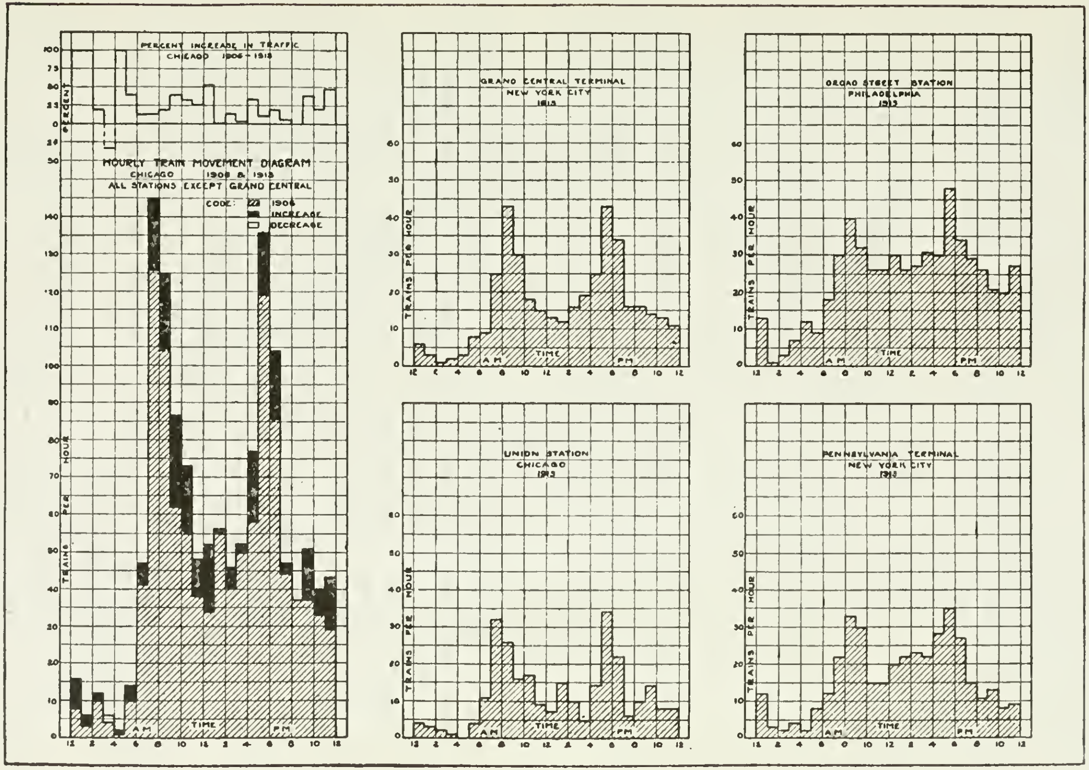
[13] Report Chicago Traction Subway Commission, 1916.



Chicago the Railroad Center, likewise a rush-hour problem. Why build monumental terminals to serve commuter traffic? (c)

1,500,000 surface line passengers. This rapid transit program comprised a unified system with enlargement and connection of the elevated system, initial short down town subways therefor, certain initial bores for relief of surface terminal line and subsequent rapid transit subways of increasing scope designed to approximate, step by step, the future needs. And what is especially important, a complete financial plan, was prepared to enable the system to become and *remain self-supporting* with conservative provisions for insuring its physical integrity as a permanent public service agency and stable investment.

The comprehensive nature of this survey should, in the public mind, have been an earnest of careful planning and conservative provision for the future. For with the great expanse of city to be covered, 200 square miles, and the resulting low density, the problem of rapid transit was unusually difficult. Yet the advantages of unification, standardization, centralized responsibility, elimination of wasteful competition, and private bickering and exploitation, did not appeal to the voters as against the counsels of opposition who favored independent systems, devoid of substantial feeders, as a means of bringing into being some supposedly idealized plan. Quite recently experimentation with various types of rapid transit systems has been proposed and received public encouragement, but always at the expense of the city backed by its enviable Traction Fund. It is to be hoped that saner counsels will prevail in the end when the full technical problem is more widely appreciated.

Steam Railroad Transportation: Competitor or Adjunct? In all large metropolitan areas traversed by radial steam lines, these must be used more and more in the future for long distance rapid transit service; for the private rights-of-way most suitable for high speed operation already exist and could not be duplicated at any feasible price. In the largest cities, grade separation has already been largely carried out to such an extent as warranted by the abutting development. The commuter fares to the distant suburbs are already on an extremely low basis, to encourage suburban settlement. The terminals are located reasonably close to the business center, which encourages a considerable diversion of the total rush peak load because of the possibility of passengers obtaining seats by walking to the terminal station. For the inlying suburbs, the steam service, as at present organized, is not so well suited for convenient rapid transit, but this will be improved by ultimate electrification.

Electrification: In view of the strategic position of the steam lines, one would be guilty of lack of vision in neglecting to appraise these steam lines at their true value as part of the great ultimate transit scheme. Electrification of these lines suited for suburban service must come about as the density of train service becomes too great for efficient operation. But this electrification cannot be carried out all at once, as often advocated by over-enthusiastic citizens. The additions must come in a logical and orderly way, just as a power plant and distribution is expanded to meet additional local load; otherwise the project will be crippled financially for long years to come. New York's first electrification happened to be brought about by the Park Avenue tunnel disaster; it would have been sure to come in time. The Pennsylvania electrification was necessitated by tunnel operations; but the West Philadelphia electrification was brought about through the pressure of demand.

In Chicago, over 40 steam roads operate within the city in 26 major systems, a number of them ideally situated for electric suburban service. While these roads are now discharged from government administration, the advantages of unified terminal control have undoubtedly been realized to a greater or less extent, and it is inconceivable that the future will not bring forth desired co-operation of the steam lines in rapid transit development. The great Illinois Central electrification will be a good start in the right direction, especially as the new lake front terminal can accommodate much if not all of the other terminal properties now blocking the throat of the south side business district.

Type of Station: But for most effective operation, further terminal improvements will be necessary. The Illinois Central lake front plan offers an excellent example of this necessity. For it must be realized that monumental steam terminals, however grandiose and expensive, are not suited for rapid transit service. What is needed is a system of distributed stations on the plan of the Illinois Central lake front suburban lines, which serves the business district *throughout its entire length.* In this respect, the usual downtown steam terminal is extremely deficient. Even the Northwestern and Union Stations of the West Side ultimately will, in all probability, find it desirable as the business district expands, to revise their suburban service by means of a through service from north to south worked out in some manner through co-operation with other connecting lines of the railroad network.[14] This will probably require in all large cities depression of the railroads below the downtown streets, but connecting with the elevations outside. Otherwise, the business district will eventually become surrounded by the "Chinese wall." This danger is well illustrated by the Northwestern elevation on the west side; for business does not expand readily through restrictive gateways.

Through Routes and Unification: Ultimately, through routes in railroad suburban service will no doubt be found as practicable as they have been found in the case of surface and electric rapid transit lines. Such through routes have already been in operation many years in Berlin and Pittsburgh, and plans have been worked out for connecting North and South Stations, Boston, in a similar manner. It is inconceivable that Chicago should overlook such an unexampled opportunity as a lake front route connecting the Northwestern and the Illinois Central electrifications, and also others in the northwest and southwest zones. The Arnold report

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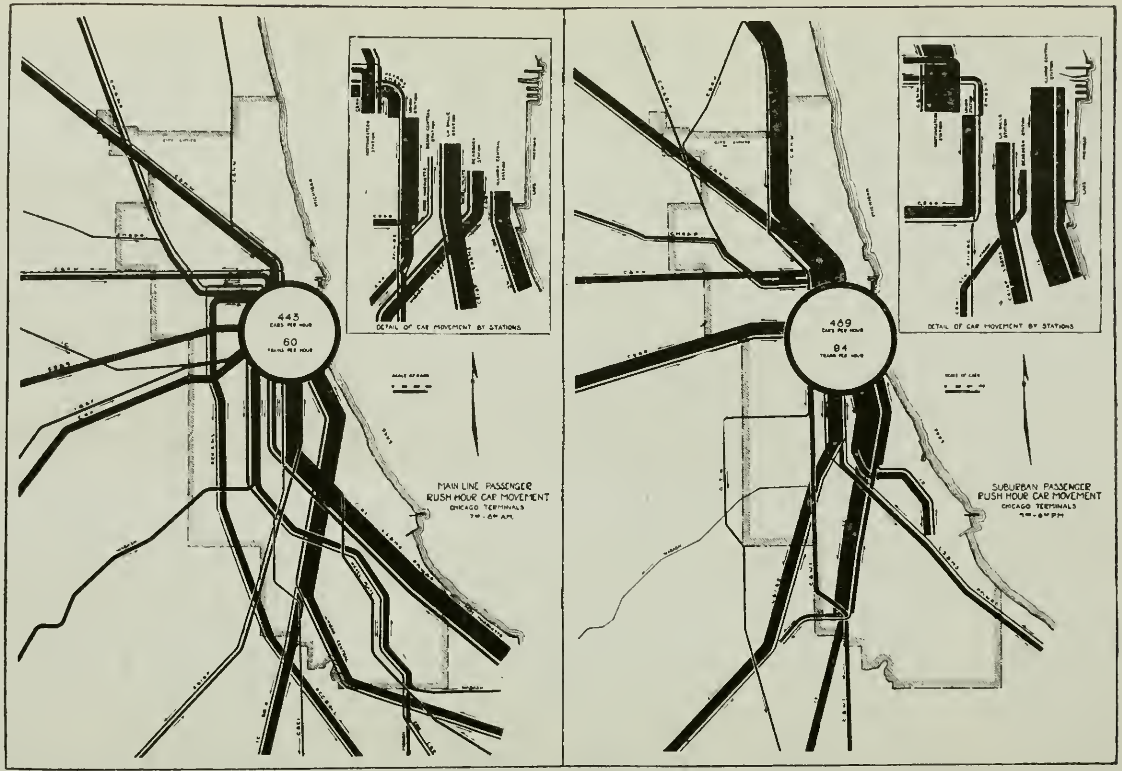
[14] Arnold Report on Chicago Terminals, 1913.



Why the Commuter Demands Consideration. The suburban service exceeds through service. This is a rapid transit rush-hour movement and entirely distinct from a normal railroad terminal movement. (c) further sets forth the possibility of electrified steam through routes bisecting the Chicago business district.

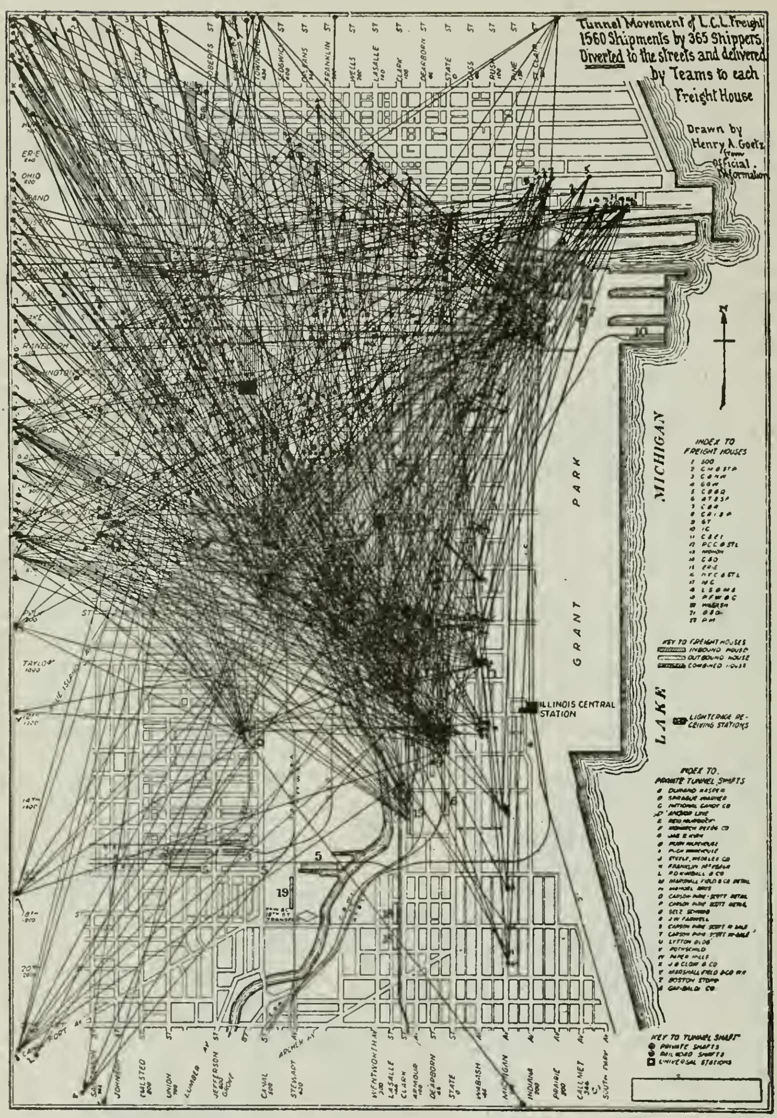
To be sure, these through routes will require the interchange of equipment, yard terminals, coach yards, etc., resulting from the over-lapping service. But these conditions, now opposed largely from the viewpoint of independent competitive operation, will be completely remedied when the day arrives for that far more important consideration dictated by economy and common sense, viz., *complete ultimate terminal unification.* And it has seemed to be within the bounds of possibility from the preceding discussion, that this unification may possibly include not only the interchange of railroad trunk line facilities, but also close operating co-ordination with the remaining rapid transit agencies, viz., subways and elevated and surface lines.

It will now be clear that, in order to develop along efficient and far-sighted lines, it will be of greatest importance for cities to plan their future with a full comprehension of all these factors, and with a concentrated authority and administration, of sufficient experience and ability to force steady development along a broad, consistent plan. A continuation of independent piece-meal competitive development of the past will ultimately be found a serious embarrassment. Here again the technical profession must fulfill its duty and utilize its collective experience and judgment in securing a proper public administration of the City Plan and widespread understanding of its necessity by the public.

Undeveloped Possibilities of Relief: Pending the maturing of the basic transportation plan, which will require years and perhaps decades, and in fact can never be wholly complete, there are a number of immediate possibilities for relief of existing conditions which should receive early consideration.

Chicago Freight Tunnel: In Chicago exists a system of freight subways covering the entire business district, with 65 miles of tunnel, and which can be developed into perhaps a most refined system of freight classification in existence. In effect, this tunnel is a *sub-level freight-handling street system already constructed,* such as exists in no other city in the world. For various reasons, which it is not necessary to dwell upon here, this tunnel has never been used to its fullest capacity, which is possibly 10,000 tons of package freight per day. Ultimately, by means of "universal stations," any shipper may deliver freight directly for any number of consignees and receive a final bill of lading without further trouble; the tunnel carries out the classification and delivery to the various outbound freight houses. The present daily haulage of nearly 2,000 tons will require from 750 to 1,000 trucking trips per day over the city streets. This occasions a demand for 250 to 300 vehicles in constant service. To remove from the city streets such a vehicle movement then represents the chief civic advantage of the freight tunnel. As time goes on, this relief will be more and more apparent.

The Tunnel has been thus far a financial failure by reason of various conditions which it is believed can be corrected and its



Forgotten—the Chicago Freight Tunnel. A mental picture of what would happen if only two freight stations of the Tunnel were shut down and freight hauled by trucks. Yet the Tunnel is only being worked to 20 or 25 per cent capacity. (g)

ACKNOWLEDGMENTS

(a) Refers to report of Chicago Traction & Subway Commission, 1916. Messrs. Parsons, Arnold and Ridgeway.
(b) Arnold report on San Francisco transportation problem.
(c) Arnold report on Chicago terminal problem.
(d) Arnold report on car operation, Rochester, 1916.
(e) Traffic report for Board of Supervising Engineers, Chicago, 1916.
(f) Arnold report on South Water Street improvement, Chicago, 1920.
(g) Traffic studies by Henry A. Goetz (deceased).

economic status thereby reversed. Chicago cannot afford to permit this valuable ready-made agency to fall into decadence, as it is a vital factor in its great City Plan.

Merchant Transport: Another opportunity neglected through lack of understanding of its possibilities, is the more effective use under proper city regulation of the vast system of surface transit and interurban lines in all large cities for transport and delivery of city merchandise, express, package freight and perishable foodstuffs. The electric railway industry of the United States comprises nearly 50,000 miles of track, nearly equal to the entire steam railroad mileage of the Southern District, and not far from that of the densely settled Eastern District. This mileage reaches every settled part of those city areas within which dwell one-half of the total population. In 1916 the property account of the United States railroads averaged about $2.80 per $1.00 annual gross revenue. The electric railways required about $3.00 on account of expensive city construction. But this great mileage is now used for passenger business alone, although readily adapted to merchant transport also. While the rates allowed the electric lines probably averaged 2.0 cents or under, the steam roads received 2 to 3 cents per passenger mile. And the steam road freight earnings are nearly three times passenger earnings; on the electric railways, freight represents but a small fraction of the earnings, or nil in the case of the city systems.

Conservation: If through advanced public policy and reasonable regulation as to suitable equipment, hours of operation and rates assigned, it were possible to utilize this vast idle equipment during the non-rush hours for merchant transport, it is difficult to conceive the possibilities of relief resulting in hilly cities, like Pittsburg and San Francisco, requiring 5 to 10 miles trucking haul with 300 to 500 feet climb, or in large flat cities like Chicago, where trucking hauls run as high as 15 to 25 miles. But most important, this increased revenue from otherwise idle investment, offers to American cities a hitherto unrecognized means of keeping down the passenger fares, urgently desired by the public. It is quite possible that such a system will become the only alternative to widespread financial collapse of urban transportation.

Here indeed is one method of attacking the so-called high cost of living, which rightly should be labeled, "high cost of doing business." Thus, Conservation of Resources, which has become the established policy of the government, may well be regarded as applicable to this critical situation, involving as it does a capital investment estimated in excess of $4,000,000,000 and requiring an estimated new capital outlay of from $200,000,000 to $600,000,000 per year to sustain normal progress.

RECAPITULATION.

Concluding this necessarily broad review of the great technical field of City Building, attention may be directed to certain matters which the author regards as fundamental.

1. Are City Transportation Plans being developed along intelligent, economic lines with a proper conception of the future and on the principle of the greatest good to the greatest number?

2. We do not want mere bigness in population, industry or wealth, if civic development cannot be efficient and wholesome.

3. Cities must be de-centralized when they grow beyond certain convenient transportation limits, both as to passenger and freight movement; to focus all business, traffic and community life in a single downtown district is wholly improper, inefficient and inequitable.

4. Intercommunication by streets and transit lines should be as direct as possible to avoid detours and unnecessary passenger mileage; the city center should not be turned into a terminal yard or transfer platform.

5. Through routing offers the best cure for the remaining traffic necessarily reaching the business district and encourages normal and equitable business expansion.

6. Sub-centers of business and industry should be encouraged and developed to the maximum possible extent; also the walking habit in the outlying residential districts and industrial localities—a matter intimately associated with the program of city zoning.

7. Perfection of the existing street system is a first necessity to permit local transit development without causing needless restrictions and detours; centralized control of future subdivisions and the City Plan is equally necessary with the same end in view.

8. Rapid transit development should be carried out with complete unification and should be standardized as fully as possible in its major divisions of street, elevated, subway and railroad suburban service.. Any system conceived upon selfish, predatory or even competitive lines must eventually fail or the cost be finally absorbed by the Public.

9. The broad economic problem is not one of today alone, but involving the rights and responsibilities of several generations—past, present and future. No other conception permits of equitable adjustment.

10. The American people broadly want good transportation service first and are willing to pay for it. Any restrictive plan of development must result in stunted civic growth and untold economic loss too complex to estimate in mere figures.

11. Finally, Conservation, the one big national concept of the century, stands out as a profound public need at the present time. But it must be based on sound economics and not be warped by either corporate aggrandizement or political expediency. Chicago is indeed fortunate in having the benefit of the vision of a broad City Plan, and possessing the existing elements of an unexcelled future transportation system. Moreover, it has the tools to

work with in the form of a $26,000,000 traction fund accumulated, not from capital issues, but from the net receipts of local transit. It is a curious commentary on the lack of foresight and constructive public support that certain sections of the public press originally opposed the conclusion of one of the greatest constructive measures ever put in force by the people of Chicago on the ground that these "net receipts" would be "NIT receipts."

The Author's parting word is to study history and for the technical profession to grasp with a firm hand the present opportunity for guidance in these great civic problems.

DISCUSSION

Mr. Pond: I could ask lots of questions, but I don't believe I could tell you very much. I was aghast at the amount of information that has been poured out this evening. I can only say that it has been quite an educational process with me. I have felt that I have known something about the building of cities, and I have felt that we have sometimes thought, not having studied our Chicago Plan closely enough, that it was merely a picture and not *a dream* that could be realized, but it has at its base something that can be realized. We can have the city beautiful, as it was mistakenly called in the first place; we can have the city practical, and the city practical has got to be brought out by the man practical, and the man practical has got to be a man of vision, and I am glad to see that the technical societies do contain men of vision, and not only men of vision, but men who are men of genius. They can put that vision to some account. They have the capacity for detail which makes genius, and which helps the man of vision. The subject has been so thoroughly treated and so exhaustively treated this evening that I don't think I could add anything to it. I am going to take home and digest the book, and also what I have seen and heard here tonight. (Applause.)

Harold Almert: As is generally the case with any business that is everybody's business it generally becomes nobody's business. The solution of these problems referred to by Mr. Bibbins would ordinarily be expected to be handled by the municipal council. After hearing Mr. Bibbins tonight, and with your knowledge of the make-up of the personnel of the average city council, added to that the wide scope and diversity of affairs that they have to handle, the amount of business there is for them to transact, the urgent demand on the part of their constituents for immediate relief from one trouble or another, shows how absolutely impossible it is to expect a municipal body of that kind to work out and to look far enough ahead to give us anything like the service which Mr. Bibbins has called our attention to tonight.

It seems that the only solution will be for the big body of technically trained men, the Civil, Mechanical, Electrical and Architectural, to band themselves together and to make it part of their civic duty to work out this solution by a careful series of studies and conclusions, and then put the weight of their organizations behind it.

As already stated, what is everybody's business is nobody's business. It would be wonderful if we could make the solution of Chicago's transportation problem one exception to that rule, like the new life insurance agent who hadn't studied human nature and wasn't able to pick his prospects, and unfortunately tackled a tramp, without a nickel in his picket, and started to telling him about the various policies that he had, explaining the endowment, the ten year and the twenty year and the various policies, and after he got through the tramp looked at him and said, "Well, which one of them is the policy that you can advance a quarter to me right now for a meal?" So most of us think, "Well, what is there that we can get that will come to me right away."

I have advocated a number of times the better ultilization of some of the facilities that we have, and because of the unfortunate financial condition at this time, the inability of these utilities themselves to get money at anything but a prohibitive price, their impaired credit, the high cost of labor and material, it is perhaps fortunate that we have come together at this time to do some planning. This is certainly not the time for building, but can we make better use of what we have at this time? During the war when we were looking for conservation in every way possible I had occasion to make some studies of the transportation in Chicago, and found that we can do considerably better, both as to decreasing the cost and for increasing capacity of present facilities. At the time when the surface lines and the city council were at loggerheads about the extension of the franchise or the renewal of the franchises, I had worked out a complete report on surface transportation in the Loop. At that time the only object was the conservation of fuel, but the two were so closely interlinked, service and conservation of fuel and power, that they all had to be considered together. The plan was approved by Washington and the head of the department at Washington came on the very next train to have it put through, and adopted my plan as a general plan for the improvement of service in all large cities. But because of the fact that the city and the traction company were in that campaign at that time I didn't want to complicate matters by a revision of traffic in the loop at that time, so I waited until the November election was over, and then came the Armistice and my war work was at an end. The plan, however, was submitted to the surface lines, who were considering my preliminary plan at the time. Whether Washington sent them my final plan or not I don't know, but it is possible from the study which I made to reduce the number of car stops in the loop from twenty per car mile during the rush hours to eight per car mile. In other words, to get the surface lines out of the loop in half the time, or to run double the number of cars in the same time, which is a material help, and requires absolutely no expenditure of money. To do that required double berthing of cars, meaning that at the street corners where the cars stop to load that two or three cars would be loaded at once, or that if a car made a stop near a crossing because of another car just ahead of it, the second car would load right there and not move up to the corner and make a second stop to load.

Where cars are to turn off they would turn the corner first and then load so as not to block the main line. In addition to that it contemplated a more careful working out of the transportation policy proposition in general. Many unnecessary stops are caused on the surface lines now by the traffic police in not exercising the necessary judgment and blowing the whistle at the wrong time, causing many unnecessary stops.

Elimination of parking of the vehicles along the car line streets during rush hours was another provision, and some re-routing of cars and a few streets were made one way streets for vehicular traffic.

These are some of the things which we can do to improve conditions immediately, and without the expenditure of money. If you notice the amount of space under the elevated structures, one can't help but be impressed with the opportunity in a big city like this of the need and the desirability of the utilization of that space for markets, for perishables such as garden truck, and by bringing these goods in over the elevated roads during night hours reduce the cost of transportation by greater utilization of our present facilities.

Some four or five years ago I found that some eighty per cent of the milk coming into the city of Chicago comes from Madison Street north, and those arteries of the elevated lines in co-operation with the surface lines certainly could be used for the carrying of milk and garden truck into the city at night, and if necessary, in electrically refrigerated cars, coming in at the late hours of the night to the stations, where they could be switched back with no frogs against the direction of traffic, giving us fresh milk and garden truck from a number of stations along those arteries where we get it right fresh from the garden and the following morning find it delivered or on sale and passing through a minimum number of hands, resulting in a lower cost and more wholesome product.

In addition to that, a large amount of traffic by trucks going into the suburbs—think of the opportunity to utilize the tunnels that are now hardly being used. In connection with the study of the elimination of delays in the loop traffic, I found that most all of the large business houses in Chicago have connections with the Illinois Tunnel, but they don't use them. They would rather use the surface of the streets because of a lower cost by trucks. If it were made necessary, or if the trucking during the rush hour was prohibited on the surface, they would go to the use of the tunnel, increasing the use and reducing the cost of use. By loading a number or freight cars at tunnel terminal during the day, sending them out into the suburbs over the elevated lines during the late hours of the night, would give a revenue to those lines that would help to reduce the cost of transportation and facilitate matters very materially and reduce the congestion on our streets.

Another point that was not brought out in the paper. First, so far as is physically possible the transportation company should provide means of transportation for the public to ride when they like and where they like, but when you run against conditions such as you have in the city of Chicago today, because of physical and financial obstructions, in order to improve conditions, temporarily, at least, perhaps it is the duty of the public to help. If you take a condition where every street car rider and every elevated rider in the city of Chicago, at an appointed time of say 8 o'clock in the morning, every one of them stood at their corner ready to give the signal that they wanted to get a car down town, think how inadequate any system of transportation would be. Take the other extreme, now, if, instead of suiting our own convenience as to the time of going down town the time was selected for each and every one of us, so we would ride whenever it was most convenient for the transportation facilities, so instead of the peak in the morning of thirty minutes or an hour, and the same time in the evening, there would be set a time for each and every one of us to ride. There would be a seat for everybody. Now between those two extremes what can we do and what should we do to help remedy the situation? It is the same condition exactly with transportation as it is with the distribution of electric energy. We all know that diversity factor is one of the very important things which helps to decrease the cost and to make the investment work over a much longer period. Now, if we were to bring about by the co-operation of the Chicago Association of Commerce and by the various trade associations throughout Chicago an arrangement whereby we would stagger the time of the opening of the stores, factories and offices in the morning, and stagger the time of closing them in the evening, also stagger time of going to luncheon, we would have a condition there which would aid our transportation facilities very materially and avoid the present terrific crowding.

If you will look at Mr. Bibbins' diagram there which showed the peak load in the morning and the peak load in the evening, the one hour peak as I remember it was something like 100 per cent greater than the two hour peak, and if we had a diagram to show what the thirty minute peak would be, the chances are we would show the same extreme there. In other words, because we all want to ride during a certain thirty minutes in the morning and the same at night, requires our transportation companies to double their investment. That added investment is idle 23 hours per day.

The interest and depreciation on the added investment in order to take care of that peak for thirty minutes in the morning and thirty minutes in the evening is largely what makes a five-cent fare impossible today and causes the crowding and inconvenience to so many. If the Chicago Association of Commerce will undertake to organize all of the manufacturers, wholesale and retail organizations of Chicago, and work out a comprehensive plan of staggering business, our transportation difficulties can be promptly solved, cost of operation reduced to a minimum, and the capacity of restaurants, picture shows and other retail establishments could serve double the number of patrons with their present investment, in other words they could take in two dollars for every one now. (Applause.)

Chairman: Dean Hayford of Northwestern University always has intelligent thoughts on all subjects and particularly on subjects of such importance.

Dean Hayford: I hoped I had escaped. I have been very much interested. But it is beyond my power, I believe, to add anything to the very thorough treatment that has been given to the subject.

I will take the chance, however, to emphasize for a moment one of the ideas, or lines of thought, of the paper. On pages 5 and 6 it was suggested that the engineers have a special duty as a group. That is the duty which I would like to emphasize. Engineers are especially equipped to understand this kind of a subject. Because they are so equipped it is their responsibility to a greater extent than that of any other group to educate the public. It is suggested in the paper in that connection that there should be the widest public discussion of worthy projects, referring to this general line.

It seems to me that there are some decided advantages, as suggested by Mr. Almert, in having the discussion of such a topic as Mr. Bibbins has dealt with separated from the discussion of any definite project. Perhaps it is best to get these questions discussed now when no particular project is up, because at such a time as this we can get at the general principles and the real merits better than when the special interests of a particular project are involved.

If the engineers as a group are going to have success in helping to educate the public, they must learn to do much better than they do now as public speakers. Engineers must learn to hold and interest an audience on a technical subject, or any subject that the audience ought to be made to understand. Engineers must learn the art of public speaking.

It seems to me that on an average the engineer has the mistaken idea that when he has learned his subject thoroughly, has the right conclusions and has put them in a blue print, or in a diagram, that most of the job is done. The strong men among the engineers do not look at it that way, but many engineers do. It seems to me that when one has come to that point only the easier half of the job is done. The harder and the more important half is to get the ideas across to someone else, in such matters as we have heard discussed tonight. To get the ideas across to the public.

It seems to me that if the engineers would rise to their chance and succeed in educating the public, you could get, in a general way, the following series of events: (1) You would get a better educated public. (2) You would get a municipal government that would act more intelligently than the municipal governments now do, because the government would have to respond to the expressed opinions of the people. (3) Then, when you had the better city government, you would get a better solution of such problems as have been discussed tonight. So I come back to the proposition that it is extremely important for engineers to learn how to talk before the public and then to do it and educate the public. (Applause.)

Chairman: There are quite a number in the audience who have trained their powers of speech. I am sure we would be very glad to hear from any of them. Mr. Howson knows he is one of the guilty ones and he is trying to escape.

Mr. Howson: I was very much interested in the paper. I think that Mr. Bibbins has presented the subject in a most masterly way and has shown us the absolutely basic part that transportation plays in civic development. That thing was impressed on me more than any other point. He brought it out from many angles that civic development is absolutely dependent on transportation, and that an accurate analysis of the methods of transportation is the first consideration on which other phases of our civic development must depend.

Chairman: After that experience anyone that gets up is likely to be called on; but don't wait until you are called on, please.

Mr. Allen: One of the gentlemen said that what is everybody's business is nobody's business. It seems to me that this question of providing the proper transportation for large cities is exactly the thing, that this is everybody's business. The paper tonight shows that it is strictly an expert's business, and in my opinion the reason we get such poor results from the city council is just that reason, that it has got to be done by experts, and, in my opinion, most of the remedies or most of the changes that will have to be made will not be popular when made. A skip-stop is not poular with the public. Hardly any of the changes recommended in the present plan would be popular, and that is especially true, I think, when you come to the matter of rates.

Now, as I see it, the public has got to be educated, not only to learn a lot of new things which they don't know, but they have to unlearn a lot of things about transportation which they think they know about it. Take the matter of zones. It seems to me there is no solution for the fare proposition in the city of Chicago, with the property costs going up all the time, except the zone fare of some sort, for the reason that if you merely increase the fares horizontally it destroys the usefulness of the service to those who only want to ride a short distance; that is, they won't ride at all, and it is a very serious proposition. The real solution of it is to keep low fares for short distances but to increase the fare for those that ride a long way, and those to whom a long ride is worth more money. That probably never came up as long as the average fare could be kept at five cents, but if the average fare has got to go to eight cents, then you are going to lose a lot of former five-cent traffic. That will not be popular with the public, although I think it will work all right.

In the paper I think the suggestion was made that if you did have zone fares it would put a rubber band around a certain part of the population and keep it in and force tenement house dwelling, etc., but the diagram shows that more than half the city area has no population, even though it has a flat five-cent fare. I think the reason of that is *service, not fares*. The street car companies with the flat fare, certainly will not build out into open areas if they can keep people congested on the nearer routes, but if you allow them to go out you will get a service that will take the population out. I am not at all sure but that the poulation will be distributed better with the zone system than the "one city, one fare" idea, if you take the combination of good service and reasonable rates. I doubt very much if people keep near the center of the city wholly on that account. I think it is chiefly for service facilities, and not fare, and if they would get out a mile or two further by paying one or two cents, they would be glad to do it.

Another point that the public has got to change its ideas on, and one which I have been listening to today more or less, is this matter of the contract ordinance. The fare in public utility service is something that is in no way rightfully subject to a contract, because the equation which expresses it is $X - Y = A$. X is the gross revenue, Y is the cost of the service, and then you say it equals A, which is the five-cent fare. Every engineer knows that cannot be solved. You have to have two equations, but a contract ordinance is merely a chance, when it is first put up, for a good horse trade. There is absolutely no possibility of anybody knowing that five cents is a proper fare. Therefore, every time it is put up they try to make the *best deal* they can. Today a *contract ordinance* has no place in a modern utility management. The service must be paid for and you mustn't even try to guess what the rates are going to be in advance. It is not to the advantage of the public to do it. If you try to do it and try to pass an ordinance on that basis, each one is trying to get the best of the other, and it is never in the interest of the public. Therefore, we should educate the Chicago public to say, not that we insist on a contract ordinance, but that we won't stand for it at all. (Applause.)

By O. C. Spurling,
Western Electric Co., Hawthorne, Ill.

Mr. Bibbins' paper is very comprehensive and undoubtedly represents the result of a large amount of time and study devoted to the subject of city building and transportation. I can think of nothing to add to his paper other than some notes which tend to corroborate his statements.

In one part of his paper he compares a city to an industrial plant and it may be interesting to tell of the experience of the Western Electric Company in providing manufacturing facilities for its business.

From 1869 to 1903, manufacturing space was secured in Chicago and New York City as the demands for additional space arose. This resulted in moving to one location after another as each one became too restricted for the growing business needs. In some cases adjoining property was purchased at a very high price, and the old Chicago plant, occupying the greater part of the two blocks bounded by Van Buren, Clinton, Harrison and Jefferson Streets, was for several years a horrible example of a failure to have a comprehensive plan for development before starting the erection of an industrial establishment.

In 1903 the Company acquired large tracts of land where its Hawthorne Works are now located. General plans for the development of the entire property were made before any building construction was started. Certain definite areas were assigned to the different classes of manufacturing in which the Company was then engaged, and the initial building program was based upon a definite plan for future development although all the details were not worked out.

The first buildings were occupied in the winter of 1904-1905, and by 1906 plans were in existence for the erection of manufacturing buildings over the entire site, and the serving of them with power, light, water, gas, air, and so forth. As the need for additional facilities has arisen, the plan for the development of the entire property has been consulted and construction authorized in accordance with it. This policy has saved the company much time and money, paying handsome dividends on the time and effort expended in the preparation of the ultimate plan.

Reference is made to the immense importance of the traffic signal in increasing speed of traffic movement and promoting the maximum volume of vehicle and car movements.

I would like to put in a good word for the need for universal traffic regulations in all cities. It is confusing to the Chicago citizen to find in New York City that one blast of the whistle stops north and south traffic, while in Chicago it stops east and west traffic.

Mr. Bibbins states that the physical capacity of streets is capable of fairly definite computation, from which one may draw the conclusion that there is a definite relation between the size and locations of streets and the heights to which buildings may be erected in order to be able to furnish good transportation. He refers to the recent action of Chicago in raising the limit of building height from 200 feet to 260 feet, and if he has any definite figures I should be interested to have him tell us what the limit of building height should be for the city of Chicago with the layout of streets shown in the Chicago plan.

The cities of London, Paris and Berlin have for a long time had regulations limiting the height of buildings, definite relations being maintained between the widths of streets and the heights of buildings fronting on them. This has resulted in buildings of moderate height, say from six to eight stories high, and as a consequence the number of people who may be concentrated in a given area during business hours is very much less than prevails in cities like New York. Prior to the war, traffic congestion in London, Paris and Berlin during the rush hours was probably less than that obtaining in New York City under normal day traffic conditions.

It may, however, be argued that transportation facilities in London, Paris and Berlin have not been developed to the capacity of the streets, that is, above and below them.

Reference is made to the development of sub-centers, giving as an example the Wilson Avenue District. This tendency to decentralization is shown very strikingly by the Telephone Companies, whose engineers have worked out the advantages to be secured by several exchanges in certain strategic locations about the city.

Referring to the statement that "geographic and political boundaries should have relatively little weight in working out the problems of growth of a great city, and that the boundaries of the commuters' zones really fix and determine the transportation problem."

The ordinances of 1907, by which surface lines were cut off at the city limits of Chicago without reference to the transportation needs of Chicago's suburbs, do not seem to have been influenced very much by this opinion.

While I have been very much impressed by the wide scope of the paper, I note several references to the fact that it is not sufficient to give time and study to the development of a plan such as Chicago is fortunate enough to possess. It is also necessary to face the fact that the plan is of no value unless it is put into effect, and the putting of it into effect is the biggest job which we have.

The Chicago Plan Commission probably deserves all the praise which Mr. Bibbins gives to it, but we cannot get away from the fact that the voting public has failed to endorse surveys and reports bearing upon Chicago's needs. What is now most needed is wider publicity of the advantages of the Chicago Plan, for which purpose we perhaps ought to create an advertising department, securing the best possible talent to serve it.

Chairman: I am sure all of you will agree with me that we are very much indebted to Mr. Bibbins for this splendid presentation tonight. We have learned a very important lesson, and we know something about one of those big fundamental problems which will determine very largely what the future of this city of ours is going to be. We will go away from here tonight knowing that the transportation problem is not merely a problem for the transportation engineer to provide a moving compartment and the necessary space to carry a certain number of people from a certain scattered section of places to another; but that is one problem, the correct solution of which requires the training of much more than just one profession. All of the technical professions should be drawn in. It requires the engineer, the architect, even the lawyer, the doctor, the sanitary engineer, before the proper solution really is reached. The engineers, as Dean Hayford has very well said, have a special obligation on them because of their special training, likewise the architects. The doctors and lawyers and so on are called in when those particular problems have to be settled and those particular problems have been called in. But those of us tonight who heard this I am sure all feel that at least our city fathers and city officers ought to have heard this talk, if not the entire citizenship of the city of Chicago. But they were not here, so it puts a special obligation on us to tell our friends and our neighbors something of what this means to our city. With that duty fulfilled there is some hope that Chicago in the future will be the sort of Chicago we would like to see it.

With that end in view, and with the thanks of all of us present to Mr. Bibbins for his splendid paper and address, we will stand adjourned.

Adjourned at 10:20 p. m.

CLOSURE—J. R. BIBBINS, A. I. E. E., MAY 12, 1920

The author's comment on the discussion may fortunately be brief and positive rather than negative. His text, "Are We Developing Into Mechanical Cities?" originally suggested by Mr. R. F. Schuchardt, still forms the major issue.

It will be eminently helpful if, as Mr. I. K. Pond remarked, both engineers and architects unite in the basic view that dreams can be realized and that the surest medium of this realization will be through judicious merging of the ideal and the practical. Engineers are sometimes prone to forget this and both professions will do well to enlist the full strength of their respective organizations as a part of their civic duty, not in a sporadic way but by continuous intelligent pressure, as Mr. Almert suggests.

The more extensive use of rapid transit lines for express and especially for perishable produce is a present desideratum, and Mr. Almert properly cites the fact that the great bulk of milk shipments into Chicago could be handled over these rapid transit lines more promptly and at less cost if such a plan were to be worked out. The failure of all attempts at complete unification of local transit facilities in Chicago is unfortunate and consequently remains a major public issue.

To Dean Hayford's plea for cultivation of the art of public speaking, the author humbly subscribes in toto; in fact, recognition will possibly be obtained in no other more direct way.

Mr. Howson is pre-eminently qualified to appreciate the "basic part that transportation plays in civic development." This is, in fact, the principal element of our thesis and the fullest success of the profession of city planning will never come until city planners recognize the necessity of transportation surveys supplementing their own work.

The author believes that Mr. Allen did not mean quite what he said: "Today a contract ordinance has no place in a modern utility management." The present emergency verifies the statement, in so far as a fixed fare is concerned. And a rigid contract ordinance which does not provide the necessary flexibility in service, rates and fares will always prove defective and a source of incessant public clamor in just such emergencies as the war has produced. But a contract ordinance providing these desirable features of flexibility and adjustment such as only now has become a recognized necessity, would be, in the author's opinion, justifiable and, if properly worked out in its technical and financial features, could be made eminently fair and equitable.

Finally, standing out in the entire discussion is the great need of co-operation among the professions, a continued organized effort to embody their high ideals and aspirations in "practical dreams," and particularly a deeper understanding on the part of engineers of the vast field of civic improvement in which they are perhaps best qualified as leaders, rather than supine or disappointed onlookers.

If this contribution should have awakened even in the remotest degree such a realization, the author's efforts will be highly repaid.

August 20, 1920

Notice—Society Badges

THE Officers of the Society have succeeded in making a more advantageous arrangement for the manufacture of our Society badges than we have heretofore had, and the Society is now able to furnish them to the membership at the following prices:

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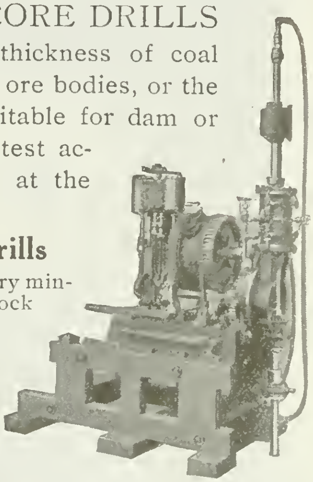

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CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV SEPTEMBER 5, 1920 Number 13

State Regulations of Public Utilities vs. "Home Rule"

The BOARD OF DIRECTION of the WESTERN SOCIETY OF ENGINEERS, at its meeting August 25th, 1920, ordered published in the Journal of the society the following resolution:

Resolved, That the Board of Direction approve the report of the Public Affairs Committee and recommend to our members and to the public the retention of the Public Utilities Commission of Illinois, and instead of impairing the law which created it, urge the strengthening of that law.

The report in full is as follows:

The membership of the Western Society of Engineers is fitted, both by training and experience, to observe, study and form an intelligent opinion as to the relative merits of the present and almost universal system of state regulation contrasted with the old and practically obsolete system of City Council control as an agent in preventing the non-functioning or the inadequacy, of utility service.

Realizing that the proper decision of this question is one of the most important matters before our citizens today, the Public Affairs Committee of the Society, after careful consideration, has compiled the following facts which should be known and kept in mind by all citizens when they have occasion to discuss or help decide the matter.

1. The old method of securing the service and establishing the rates of a utility in a city was the natural but primative one of forcing the utility to make the best bargain it could with the City Council, the bargain being expressed in the form of a franchise or "contract" ordinance. No utility at its start was a public necessity, since the public had to be taught its usefulness and desirability. Therefore, both the service and the rates were unimportant. The promoting company's chief aim was development and this was impossible if service was poor and rates too high. In other words the company was its own regulator and at first the general public was only slightly interested in its rate of profit.

2. The old system, like any commercial bargain not based on costs, resulted in poor service where rates were too low, extravagance and corruption where they were too high, and the worst kind of local "politics" and practices. In either case the public failed to get what is now looked upon as essential—*good* and *adequate service* at a *fair rate.*

3. The old system, as a matter of fact, was fundamentally unfair. The citizens elected the City Council to represent them in the bargain. The owners of the utility company similarly elected directors and officers to represent them. Obviously a "square deal' required a *third* party, as judge, to whom each side could present its arguments for an impartial decision, fair to both sides. The general public is willing that the decision should be fair. The old system makes no provision for such a result.

4. The old system has proved a failure after long trial not only for reasons suggested above but also because it left the service-using public helpless against either poor inadequate service or unjust rates, *during contract periods.* The attempt to guess what rates would fairly cover costs during such periods was as unsuccessful as it was unscientific and uneconomic.

5. The new system, of state regulation of service and rates by a commission, is the natural and logical outgrowth of the attempt to remedy the obvious and unbearable faults of the old system. Except as to railroads, this was started in Massachusetts in 1906 or only fourteen years ago, and in Illinois in 1914. At the present time regulation by commission is in effect in forty-two states and in the District of Columbia, Hawaii, Porto Rico, and the Philippines. The Texas League of Municipalities, composed of Mayors, is formulating a statute for presentation to the next Legislature. There are five commissions in Canada. It is pre-eminently the American system for handling utility companies in the interest of the public. Its growth has been slow but steady and no state which has adopted it has seen fit to repeal the law and go back to the old and practically obsolete system of municipal council control.

6. "Home Rule," so called, as now proposed, is but a proposition to popularize the old system by giving it a good name. It does not contemplate placing the responsibility upon an independent and impartial commission employed to devote its time to such matters, but proposes to continue the handling of public utilities in the old political channels where partisan interests are in position to extert unduly potential influences.

7. In our opinion the only thing that has saved any semblance of adequate utility service in Chicago under present cost conditions was the fact that the "contract ordinances," established by the City Council under the old system, and still fought for by the city administration, could legally be broken and overruled by the action of the State Commission under the working of the new system. The fallacy of "contract rates" for public service has at length been fully demonstrated.

8. The public might benefit under the old system except for two important facts: first, *good service is more important than a low fixed rate* in any city; second, no utility company can be forced to do the impossible, i. e., to give good service, or any service at all adequate, *after its receipts cease to meet its expenses.* It is our opinion, therefore, that a successful attempt to continue "5 cent fares" and other pre-war utility rates regardless of costs, would be nothing less than a calamity to the city as a business and social center.

9. In view of the above, the fact that the Illinois Utilities Commission has recently granted rate increases, after due public hearings and argument, to Illinois Utilities, is to its credit and makes for the ultimate good of the public rather than otherwise. The service using public apparently realizes this since it is not generally complaining as to the new *rates* so much as to poor or inadequate *service.*

10. Opposition to control of utilities through state commission seldom, if ever, takes the form of objection to any feature of the regulatory law under which the commission acts. There is opposition to having a commission at all, and opposition to its personnel; but no acts performed by the commission under the law, and under its oath of office, are pointed out as against public interest or as being unfair and unjust. The public is safeguarded from possible illegal or unjust acts of the commission by the fact that such acts are always subject to court review. The present Illinois law provides for a bipartisan commission. It was enacted under a Democratic administration and is now operated under a Republican administration. On this basis the Illinois commission holds an enviable record for its effort to interpret and carry out the law as written in the public interest.

11. There are forty-two state commissions in the United States and five commissions in Canada, and *they have found it necessary*, and to the public interest, to raise utility rates since the war. It is not a local issue; nor can the Illinois Commission be

pointed at as a special offender in this regard, as some are trying to make it appear. Pre-war rates are now as impossible with utilities as with other necessities.

12. The oldest labor paper in the United States, the *Union*, published in Indianapolis, recently contained the following very practical and sensible summing up of present conditions affecting utility rates of the telephone companies:

"Now the telephone service vendor is subject to the same human conditions as the merchants in any other line. It buys certain commodities and turns these commodities in to what it sells to the public. If it can buy copper and steel and chemicals and property and labor at a certain price it can sell its product in service at a price which is fixed by its expense, plus the profit allowed it by a public body. If the cost of the materials used in the production of its service increases a hunderd per cent or more, would it not be quite reasonable to expect that it might and should be allowed to increase the cost of the service sold in the same proportion? And if such proportionate advance in rates is not allowed, can we expect the telephone companies to render service on a standard set on a profit-making basis?"

13. The same argument applies to all utilities. The basis of old time rates has changed with the tremendous changes in wages and other costs. This fact seems to us self-evident and to dispose of most of the argument to restore so-called "Home Rule" so as to get back the old "5 cent fare." It cannot be done under the old system any sooner than under the new. And *service*, the really important factor to the citizen, will be jeopardized by such a reactionary change.

14. The commission has performed its proper duty in increasing rates to meet present conditions and will be an equally effective agent in decreasing them should conditions warrant reductions in the future. The utility is thus maintained at all times as an efficient going concern and enabled and compelled to give good service with fair but not excessive returns to both labor and capital. The machinery to accomplish all this is supplied by the commission.

15. Any attempt to impair the usefulness of the commission; to abridge its powers, and especially to go back to the old era of political control of utilities, in vogue prior to the time when commission regulation became the law, would be a distinct step backward; a grave menace to the industries of the state and to its people. The recent increases in rates were only the normal consequence of the increased cost of all commodities, and were far less as a rule proportionately, than the average increase of commodity costs.

The Lumber Situation

We are consuming lumber three times as fast as we are procuring it.

Experts predict our saw log lumber will be gone in fifty years.

The bulk of the original supplies of yellow pine in the South will be gone in ten years and within seven years 3,000 manufacturing plants there will go out of existence.

White pine in the lake states is nearing exhaustion and these states are paying $6,000,000 a year in freight bills to import timber.

New England, self-supporting in lumber twenty years ago, now has to import one-third of the amount used. It has $300,000,000 invested in wood and forest industries, employing over 90,000 wage earners.

Fire destroys over $20,000,000 worth of timber every year and kills the reproduction upon thousands of acres of forest lands.

Within fifty years our present timber shortage will have become a blighting timber famine.

Forests can be protected from fire, regrowth can be encouraged, conservative cutting can be practiced, reforestation can be accomplished—but it takes from fifty to one hundred years to mature a timber crop.

Forest devastation must be stopped, lands now in forest must be kept continuously productive, forest lands now devastated and idle *must be put to work.*

W. S. E.

Meetings for September

Monday, September 13th, 1920. Subject: "St. Lawrence-Great Lakes Waterways." Speaker: Major John C. H. Lee, Corps of Engineers, U. S. Army.

This will be illustrated by lantern slides. Major Lee will give a comprehensive discussion of the possibilities of this important tidewater connection for Chicago which involves some outstanding engineering problems.

Thursday, September 16th. Subject: "The Relation of the Engineer to Railroad Transportation." Speaker, Mr. James A. Peabody, Signal Engineer, Chicago & Northwestern Railway.

Between the customary duties of the engineer and the ultimate management of the properties, there exists a zone where the services of the engineer could be most useful. It will rquire vision and adaptability if the engineer can prove himself to be of service in this broad line.

Monday, September 20th. Subject: "Housing Development." Speaker, L. K. Sherman, Vice-President of the E. T. Perkins Engineering Company, formerly President of the U. S. Housing Corp., Washington, D. C. Mr. Sherman's broad knowledge of this subject and its importance at the present time, will enable him to present the situation clearly. His paper will be illustrated with lantern slides.

All meetings will begin promptly at 7 p. m. Entrance 308 S. Dearborn Street, elevator at south end of building.

Meetings of Interest at the W. S. E. Club Rooms

Thursday, September 9th, First Tank Corps Post, American Legion, 8 p. m.

Tuesday, September 14th, American Welding Society, 8 p. m.

Wednesday, September 15th, Society of Military Engineers, 8 p. m.

A Correction

In connection with the publication of Mr. J. R. Bibbins' paper on City Building and Transportation in the August 20th issue of the Journal, it should have been noted that this paper was presented to the Chicago Section of the American Institute of Electrical Engineers, Fullerton Hall, Art Institute, in which meeting the Electrical Section of the Western Society participated as customary on subjects of joint interest.

Pulpwood and Paper Situation

Ten years ago the United States produced its entire supply of pulpwood but now much of it is imported. This means freight rates to be added to the purchase price.

Indications are that supplies of pulpwood timber in New England and New York will be exhausted in twenty years.

In New York alone supplies will be gone in ten years.

Dependence upon foreign supplies of pulpwood for news print means we will be at the mercy of foreign manufacturers as to prices.

Ten years ago the United States produced its entire news print supply—now we import two-thirds of it.

Only one-third of the newspapers issued in 1919 were printed on the product of American forests.

High cost of pulp and paper mills prevent the manufacturing plants from following the timbers as do saw mills.

Much pulpwood has now to be freighted 500 miles to the mills.

We bought nearly 1,400,000 tons of pulpwood from Canada in 1918 and prices advanced from $10 a cord to as high as $25.

Personals

The Edmund T. Perkins Engineering Company will conduct a general practice as consulting engineers in municipal and sanitary work in addition to their specialty of land drainage and reclamation.

J. W. Beardsley has been appointed engineering member of the Highway Commission of the Republic of Panama and sailed for his duties on August 19th. Mr. Beardsley will be stationed at Panama, Canal Zone.

R. N. Nicely has been transferred from the Division Service Organization of the American Telegraph and Telephone Company at Chicago to the Long Lines Engineering Department of the same company in New York.

A. N. Johnson desires to inform his friends that effective October 1st he leaves the Portland Cement Association to take up his new duties as Dean of the Engineering School and Director of Engineering Research at the University of Maryland, College Park, Maryland.

Lesley C. Paul, member of the Western Society of Engineers, is now manager of railway publicity for the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. Mr. Paul was for many years associate editor of the *Electric Railway Journal* in Chicago and later in New York.

The Executive Committee of the American Society of Mechanical Engineers' Chicago Section, composed of Herbert S. Philbrick, Chairman, G. W. Hubbard, David Lofts, and Jos. D. Cunningham, Secretary, have had four meetings for the purpose of establishing various committees and discussing the activities for the coming year.

LeRoy K. Sherman, who has had charge of the construction and salvaging of government housing for industrial war workers, has resigned as President of the United States Housing Corporation, Washington, D. C., and has returned to Chicago. Mr. Sherman has become associated with the Edmund T. Perkins Engineering Company as Vice-President.

Mr. Sherman is a civil engineer and graduate of Massachusetts Institute of Technology, is President of the American Association of Engineers, and was formerly the engineer member of the Illinois State Rivers and Lakes Commission.

Notices

The American Welding Society (Chicago Section) have published an interesting little booklet, "Keep the Guess Work Out of Welding," which they will gladly send anyone interested. Simply address a card to the Society at room 511, 608 South Dearborn Street, and a copy will be sent you.

As the American Steel Treaters Society is holding its annual convention at Philadelphia from the 14th to the 18th of September, there will be little activity in the Chicago Chapter until the October meeting.

American Chemical Society will hold a big meeting in Chicago, September 6th to 10th, 1920. Registration desk at Congress Hotel. General meeting will open at 10 a. m., September 7th, in Gold Room, Congress Hotel.

Chicago Convention of the American Association of Port Authorities, at Hotel Sherman, Thursday, Friday and Saturday, September 30th, October 1st and 2nd. This convention is open to the members of the Western Society of Engineers. A portion of the program is being provided for by the Terminals Committee of our Society. Detailed announcement of the program will be made later.

The Papers and Program Committee are working on some very interesting topics to be discussed and have already arranged with some notable speakers. It is felt by the present Executive Committee that sufficient interest could be instilled into the active members of the Society to have each dinner meeting and each regular meeting very well attended. A letter was recently gotten out to all the members of the Chicago Section and from the great number of replies already received, it appears as though we are going to break some records in attendance and interest.

The Illinois Society of Engineers has voted approval of the tentative list of salaries submitted to various technical societies by the Engineering Council. There was a rather general opinion that in several cases the minimum is too low and that the list is too short and should group or classify salaries according to different lines of engineering work. The list was approved, however, largely on the ground that it is a good beginning along definite lines, even though it is not entirely satisfactory.

One of the recent activities of the Society is the appointment of a committee on the University of Illinois, the main purpose of which is to lend support to increasing the operating income of the university and the salaries of the staff. The committee will give attention also to other matters concerning the work of the engineering department of the university. Another development is a service committee which acts as a clearing house for information, receiving inquiries on various matters and securing the desired information from members qualified to furnish it.

The 1920 "Year Book" of the Society shows a membership of about 260. Plans are being made for the next annual meeting, which will be held at Chicago in January, 1921. The headquarters of the Society are at Wheaton, Ill.

The 1920 annual meeting of the American Society of Mechanical Engineers will be held in the Engineering Societies Building, 29 W. Thirty-ninth Street, New York City, from December 7th through December 10th.

Sessions will be held on the subjects of Appraisal and Valuation and the Application of Engineering to Woodworking.

The newly founded professional sections on Management, Power, Fuels, Machine Shop, Railroads and Textiles will also conduct sessions to consider the vital problems in their field. In addition a number of valuable papers will be presented at general sessions.

A memorial session for Dr. Brashear is planned, as a fitting tribute to his life and work.

The Society of Industrial Engineers will hold its Fall National Convention at Carnegie Music Hall, Pittsburgh, Pa., on November 10th, 11th and 12th, 1920. The main subject is "Industrial Education."

In connection with the convention there will be an exhibition of charts. Programs will be ready for distribution about October 1st.

A cordial invitation is extended to everyone interested. No registration fee will be charged and formal invitation cards will not be necessary. For further information write the business office of the Society, 327 S. La Salle Street, Chicago.

A. I. E. E. 1920 Activities

The Chicago Section of the American Institute of Electrical Engineers, co-operating with the Electrical Section of the Western Society of Engineers, is planning a program of definite helpfulness to the profession for the coming season. It will be the object to obtain speakers of broad experience and to assign them definitely to subjects selected by the executive committee, in some cases symposia on a given topic. The subjects selected will cover a wide range of activity in the electrical field, such as transportation, telephone and telegraph, radio, central stations, power development, the meaning and application of the federal water power bill, railroad electrification, electric auto truck, electric propulsion of ships, small motor development, protective devices, electric welding, scientific and industrial research, etc. Definite attention will also be given to the broader cultural aspects of engineering with reference to the tendencies of the higher education and the relation between the profession and the guild. Definite announcement of the entire program will be made shortly. Suffice to say that it has been the object of the executive committee to concentrate the activities of the Chicago Section on the immediate and pressing problems confronting the engineering profession, as well as local problems of technical government, public works and city planning.

J. W. Bibbins, *Chairman.*

From the National Rivers and Harbors Congress

Washington, D. C., Aug. 26.—"Chicago is more than twice as far from New York as it was six years ago. More than that—every place in the United States is now about twice as far from every other place as it was in 1914."

These rather startling assertions are made by Secretary Thompson of the National Rivers and Harbors Congress in a statement released today. The statement goes on to say:

"Of course, the number of miles between New York and Chicago, or any other two places that might be named, is just the same now as it always was—but miles are not the only things to measure by. We might use time, for instance, and it has been well said by an English writer that 'It is not mileage, but cost of transportation, which constitutes the true commercial measure of distance.'

"Geographically, Chicago is still 1,000 miles from New York, but, because of the increases made in freight rates during the past six years, the city on Lake Michigan is now, commercially, 2,100 miles from tidewater, and every community in the country has been pushed back until it is twice as far away from the markets in which it either buys its supplies or sells its products as it was in 1914.

"The whole increase was not made at once—the country never could have stood for it if it had been. First it was five per cent in 1914; then 15 per cent in 1917; then twenty-five per cent by Mr. McAdoo's order, in 1918; and now an advance varying from twenty-five per cent for the Southern and Mountain-Pacific groups to forty per cent for the Eastern group, and averaging, according to an estimate made by the Bureau of Railway Economics, 34.58 per cent for the whole country.

"Stated in another way, this means that for every dollar paid to the railroads for freight in 1914 we must now pay two dollars or more. Now it is just as certain as fate itself that every increase in cost of transportation increases both the cost of living and of doing business and decreases the territory in which our products, whether of farm or factory, can be sold. But the most vital question today is not whether we shall pay one price or another for the transportation of our goods, but whether we can get them carried at all.

"In Europe they use waterways as as well as railways. France, Belgium, Holland and Germany (as it was before the war), whose combined area is only one-seventh that of the United States, have 23,200 miles of waterways, of which they make a continually increasing use. The tonnage of goods transported on the waterways of Germany in 1905 was five times as much as was carried in 1875—and it is more than a coincidence that, in every one of the twenty years ending in 1913, the foreign commerce of Germany, which is 53,000 square miles smaller than the State of Texas, exceeded that of the United States by hundreds of millions of dollars.

"Why should not the 28,000 miles of inland waterways in the United States be made available for use?"

Increased Lumber Freight Rates Makes Slight Difference in Home Building

Chicago, Ill.—The increase in railroad freight rates authorized by the Interstate Commerce Commission will add slightly to the value of lumber to the consumer and the home builder. The increase varies for different regions and it is estimated that it will average approximately 33⅓ per cent so far as lumber is concerned. That means the addition of one-third to the cost of transportation, but since such expense is but a relatively small part of the total value of lumber which goes into a house, it is not to be expected that it will materially affect the building of homes.

Lumber weighs anywhere from 2,000 to 3,500 pounds per thousand feet, according to the kind of wood and its degree of dryness. Much of the yellow pine coming into Chicago takes a rate of 32½ cents per hundred pounds, so, in the case of lumber weighing, say, 2,800 pounds per thousand feet, the transportation cost amounts to $9.10 per thousand.

Douglas fir shipped from the Pacific Northwest to Chicago is hauled by the railroads at a charge of 60 cents per hundred pounds, so that the freight charges on a thousand feet of Douglas fir weighing, say, 2,500 pounds, would amount to $15. An increase of 33⅓ per cent in the freight rate means adding about $3 to the cost of transporting yellow pine from the South to Chicago and $5 to the cost of Douglas fir from Oregon and Washington points to Chicago.

With yellow pine lumber selling at $70 per thousand feet the old rate of transportation of $9.10 per thousand feet formed 13 per cent of the total value. Under the new rate the cost of the railroad haul will be about 17 per cent of the value. In the case of Douglas fir selling in Chicago at $70 per thousand feet the old freight charges formed 21 per cent of the value, while under the increased rate the freight haul will form 29 per cent.

The figures given apply to Chicago only, but they are illustrative in a general way to all sections of the country. The man who is going to build himself a home and who may use a total of twenty thousand feet of lumber in its construction, is not going to let the increase in the value of lumber due to the advance in the cost of transportation, deter him from carrying out his purpose. The added investment on twenty thousand feet of lumber would mean to the man in Chicago buying yellow pine but $60. On a house costing $5,000 to build the increase of $60 amounts to 1.2 per cent. Lumbermen generally do not believe that the home building movement of the country will lag by reason of the slight increase in the investment due to the coming advance in the cost of hauling building materials. Railroad economists insist that the higher revenues granted will improve the efficiency of the railroads to such an extent as to assist in minimizing transportation costs by cutting out the waste of delays, insufficient and poor equipment, and losses incident to poor service.

PUBLIC AFFAIRS COMMITTEE

ANDREW ALLEN, Chairman

City Zoning

Chicago and other Illinois cities are now seriously considering the important question of "zoning." A zoning sub-committee of the Public Affairs Committee of the Western Society was appointed to study the question and report to the general committee. The sub-committee consists of R. E. Schmidt, architect; A. P. Allen telephone engineer; R. W. Knight, deputy city building commissioner; Chas. K. Mohler, and Paul E. Green, consulting engineer, chairman of the sub-committee. Mr. C. B. Ball, chief sanitary inspector of the city of Chicago, who has made a very thorough study of the question, has given unstintedly of his time, the benefits of his knowledge and experience to the sub-committee.

The committee has studied the zoning ordinances and experience of several other cities, and in detail the ordinances of New York, Newark, and St. Louis. It has followed what Cleveland, Detroit. Los Angeles, Portland, Ore., Rochester, St. Louis and other cities have done along these lines. It accordingly wishes to submit its report, with recommendations and conclusions, embodying, first, a short summary, second, a general discussion.

SUMMARY

DEFINITION: Zoning, as applied to cities, may be defined as such comprehensive regulation, by districts, of the use of real property, both public and private, as will insure its being put to its highest and best community use and maintained there.

FOUNDATION WORTH. The first steps

in preparing for the comprehensive zoning of a city should be:

1. To map and study the main topographical features, bodies of water, water courses, hills, valleys, etc., embraced within the jurisdictional area.

2. To map and study the highways of commerce; navigable waters; the location of existing railroads, interurban railroads and rapid transit lines, and the most suitable location for those yet to be developed or built.

3. To make a complete survey and study of the street layout and to differentiate between residence and traffic streets.

The street plan survey and study should embrace not only the entire city, but also all adjacent territory for at least three miles beyond the corporation limits (including adjacent municipalities) and extend to include the main county highways for a still greater distance. (It may be noted that the Rochester, N. Y., ordinance provides for planning streets two miles beyond the corporation limits.)

4. To ascertain the use, occupation and relation to each other of existing streets, and inclosed areas together with the street grades, widths, drainage, water supply and paving.

5. To determine the best ratio of lot occupation for the various residential and industrial districts.

Such a study will show the logical or necessary zoning system and regulations to be adopted.

DETERMINING FACTORS OF ZONING. The problem of city zoning falls under two divisions for treatment:

First, Zoning of areas either fully or partially occupied.

Second, Zoning of unoccupied areas.

It is with the first of these factors that the modern city experiences the greatest difficulty, and the second should not be attempted until the first is determined.

The restrictions for specified districts, which the best interests and welfare of the community may reasonably demand are:

A—*Use.* Residences, one or more classes (detached residences, apartments, hotels, etc.). Business, one or more classes (stores and commercial uses, manufacturing, nuisance use, etc.).

B—*Building lines,* as to either front, or common set back lines on streets, rear or side lines of lots or parcels.

C—*Area.* Percentage of lots or parcel to be covered by building, of any of the various classes and the number of houses (families) per acre.

As a practical recommendation the committee suggests that the building or structure occupancy of a lot or parcel should not exceed the percentage of ground area indicated for the following classes and uses:

For mercantile establishments and business, 90 to 100 per cent, and that not more than 10 per cent of the area of such buildings shall be used for light manufacturing.

For industrial plants or heavy manufacturing, 100 per cent.

For hotels, 90 per cent.

For apartment or tenement houses, 65 per cent for inside lots, and for corner lots or parcels 85 per cent.

For detached houses or single family dwellings, 40 per cent.

D—*Height.* The height at which buildings may be erected of the different classes and uses under various conditions.

For building heights it is suggested that the height above established inside sidewalk grade of the street on which the building fronts shall not exceed the following:

In detached house or family residence districts, 45 feet.

In apartment house and commercial building districts, 1½ times the width of the street on which the building fronts, except that 1½ feet may be added to the height for each foot that the main building is set back or offset above the street limiting height from the established building line.

In manufacturing and nuisance occupancy districts, 100 feet.

Special type of structure may be given special consideration.

E—*Construction Material.* Kinds of material that may be employed to insure safety, and reasonable harmony in the general appearance and æsthetic unity, where demanded by public interest.

Where business and industry are

already established as a large or major portion of the occupancy, it is generally inadvisable to do other than place such area under the necessary "industry" or business restrictions.

Generally the area adjacent to navigable bodies of water, streams, canals, etc. (or so much of it as necessary), also that adjacent to railroads should be reserved for industrial development.

Old established and main highways may generally be expected to develop into business streets and adjacent business districts or "zones."

To insure against the undesirable and unnecessary spread and further encroachment of business and industry into territory that should unquestionably be reserved for residence, some temporary provisions should be made to regulate use of property until such time as the comprehensive zoning is completed.

The early determination of the class, use and occupancy for any district (whether residential or business) is essential, for the following reasons:

First, so that in the ownership and leasing of property, the present and future use and development in any district will be determined and known to a reasonable degree of certainty. This will result in normal development and reasonably stable values and remove in a measure the common heritage of blighted districts resulting from the indiscriminate encroachment of business and industry in residence districts.

Second, so that any public or semi-public improvements, institutions or buildings (such as schools, playgrounds, recreation and community centers, parks, police and fire stations, post offices, libraries, museums, churches, etc.) may be placed as to permanently (or as nearly as may be) serve the purposes for which they were created.

Third, so that street improvements and the necessary service utilities can be designed and supplied to serve in an economic manner the various districts during normal growth and when fully developed.

The city of St. Louis, which has adopted a zoning ordinance, has estimated that $2,000,000 of sewer construction would have been saved had the law been passed two years sooner.

ILLINOIS ZONING LAW. The zoning law recently enacted for Illinois is not satisfactory. Though ostensibly based on the police power it is partly founded on the principle of eminent domain and will have to be worked in a manner similar to that of executing local improvements. It has very cumbersome and almost unworkable provisions such as requiring notice to be served through the mails to all property owners and interested parties. Protests from a small area or group of property holders may be effective in keeping any small area out from under the restrictions of the large district to which class it rightfully belongs.

It contemplates piecemeal or fragmentary zoning, though permitting of comprehensive zoning. It is generally conceded that for zoning restrictions to stand the test of an attack in the courts they must be applied as a part of a complete and comprehensive scheme applied to the whole city or metropolitan districts.

It is a debated question as to whether the legal authority for zoning should be dependent solely on acts of the legislature and city ordinances, founded on the police power, or whether there should be some constitutional provisions carrying some of the fundamental rights required for adequate zoning restrictions. (Police power is the power, through law or ordinances, to provide for the safety and health, and to promote the general welfare of the public.)

While the present law is in the main unsatisfactory, nevertheless municipalities should without delay prepare and pass ordinances providing for zoning commissions, make the appointments and begin the preliminary work of collecting data and making studies of their zoning problems. The preliminary organization and work has to be undertaken whether under a good or bad law. In the meantime a concerted effort should be made to get a satisfactory law enacted under which perfected ordinances to carry out the actual zoning may be enacted.

As a result of the Committee's study of zoning for the city of Chicago, it is strongly of the opinion that the city administration should immediately appoint a zoning commission as provided by ordinance, and at once begin the work of zoning the city in a comprehensive manner. As it will take at least two years for such a commission to complete a plan and an ordinance, there will be time to amend the defects in the present enabling act.

The committee therefore recommends:

First, the immediate appointment of the zoning committee as authorized by ordinance.

Second, that the commission make an intensive study of Chicago, its occupation, transportation, tendencies, industries, and plan. The zoning ordinance of other cities should be examined in detail.

Third, that this information be carefully platted.

Fourth, that every effort be made to secure an amendment to the existing Enabling Act, during the time of the commission's study.

Fifth, that every effort be made to give wide publicity to the problem of zoning, so that all citizens may appreciate its importance.

General Discussion

The city of Chicago is at the present time, and has been for many years, suffering from the lack of zoning. Property values to the amount of millions of dollars have been destroyed through lack of such legislation, and if some action is not taken, in the very near future whole districts that are now good are doomed. Two glaring examples of this are Sheridan Road and Michigan Avenue (south of Roosevelt Road) both of which were formerly high class residence streets, and both of which have now become largely business streets with the attendant ruination of the adjacent residence property. There is now being built on the Lake Shore Drive a large hotel, which cannot but depress the value for residence purposes of the property to the north of it. At the same time there is no guarantee that any of the property along Lake Shore Drive, considered Chicago's most attractive resident street, may not in the very near future be converted into similar uses; in fact unless zoning legislation is adopted, this is almost certain to take place.

While these are outstanding examples there are many more modest districts in the city which in a similar manner are doomed by the invasion of various industrial enterprises, with consequent loss to the owners, and there are other districts in which industries should be encouraged to locate.

The purpose of zoning is to put the right occupation in the right place and keep it there. Some of the benefits of a properly planned zoning ordinance are:

1. Permanent development of desirable home districts, business districts, and manufacturing and industrial districts; 2, The preservation of light, air, open spaces, and the improvement in sanitation and attractiveness of our home districts; 3, An orderly growth of the city; 4, Prevention of undue congestion, not only in our less desirable residence districts, but in our office and business districts; 5, Stabilization of property values; 6, saving in the construction of service utilities.

In reality zoning though considered a subdivision of city planning is in fact city planning in its completest sense. A city plan without a zoning ordinance is like the skeletonized body. The framework is there, but the substance is missing. At the same time a zoning ordinance without a city plan is futile. The city plan which provides for the streets, parks, etc., and is not reinforced by a zoning ordinance, has only provided the first step toward making our cities a good place to live in.

Every property owner more or less vaguely recognized the necessity for zoning. He realized that the law should prevent his neighbor from so building that his property is damaged, but the thought that a man can do as he pleases with his own is so nearly universal that the average man thinks he is helpless.

Practically every large city in the United States is now considering zoning. Several have adopted or are preparing comprehensive ordinances. Among these may be noted New York, Detroit, St. Louis, Cleveland, Milwaukee, Minneapolis, Newark, N. J., Los Angeles, Rochester, N. Y., Portland, Ore., and many other cities. These cities have adopted zoning ordinances as the result of necessity, in order to better living conditions, prevent congestion and stabilize property values; and have found out that evidently millions of dollars in the construction of service utilities will be saved to the public.

Chicago, by authority of a legislative enabling act, has provided for a zoning commission, which has not as yet been appointed. The zoning act passed by the legislature would appear, while ostensibly based on police power, to be really based on two wrong theories: one that zoning may be done piecemeal, and the second that it is a local improvement which should be accomplished under theory of eminent domain. Both of these theories are incorrect, and the act will undoubtedly be amended in time as the problem is more clearly understood. The legal power to zone is now well defined as a police power, and is not a local improvement in any sense of the word, but is a general benefit to all the inhabitants and interests of the city.

Generally speaking, a zoning ordinance regulates the use to which property may be put, the percentage of area which may be covered, and the height to which a building may be constructed. It recognizes existing conditions and occupations, and should be in the higest sense a constructive document. After a thoroughly comprehensive study of existing occupation and use, together with consideration of probably future development, the city is divided into numerous districts, and the districts regulated according to use, occupation and height of buildings. Thereafter any new buildings must conform to the ordinance. It is usual to provide a method of appeal or adjustment which may be used to give sufficient flexibility to the law to make it workable. The fundamentals of a comprehensive zoning scheme will take into consideration the topography, bodies of water, streams, transportation (water and rail), streets, sewers, water supply, electric light and power, and all other utilities, such as rapid transit, local transportation, markets, etc. In fact the adoption of a zoning ordinance will have a vast effect on all these utilities, and in course of time will save hundreds of millions of dollars to a city like Chicago. The committee has not attempted to go into detail in the mater of how these different features would be affected, still it feels confident that certain broad conclusions may be drawn regarding each of the main subdivisions of the utilities, and it has drawn them, as shown in the summary of this report.

AREA OF OCCUPANCY AND HEIGHTS OF BUILDINGS.

Regulation of the use of property, limiting the height of buildings, and the percentage of lot area covered by a building are the major means used to preserve the character of a district or zone as established.

The most important of these regulations is limiting the use to which property may be put. For a better understanding of the problem the uses of buildings naturally fall under two groups and subdivisions, and the classes have been graded into groups similar to the following; *residences* (detached family houses, apartments and hotels); *business* (commercial, industrial and nuisances). In some instances residences, apartments and hotels are combined in one group, in others industrial and nuisance groups are combined.

The most beneficial effect of zoning accrues to protected residence districts and also to commercial or business property to almost as great an extent. From residential districts all other classes may be excluded, and from commercial or business districts all classes but residences may be excluded.

The principal exclusion is aimed at the industrial and nuisance group, as it is from the encroachment of these in a residence or commercial district that the greatest damage and depreciation of property values result.

A purely residential district must be limited in area or at least in one dimension. A certain amount of business and commercial buildings such as groceries, markets, drug stores, doctors' and dentists' offices, and similar places must be within a walking distance. If section line and half section line streets running parallel in one direction are devoted to local community business service use the residential district should be not over one-half mile wide by an otherwise determined length. The regulation of churches, schools, other public buildings as well as service utility buildings in residential districts is always a vexing problem.

Commercial and business districts are more easily regulated. As a rule they seek locations on the established transportation routes and the main arteries of public travel, generally upon one important street and usually have a tendency to increase in numbers and extent along the street instead of broadening the district by spreading to side streets. It is when a residence district becomes densely populated by the erection of a large number of apartment buildings that business begins to encroach upon it by establishing a handy store or two in the heart of the residence district.

As before stated, industries generally establish themselves along the highways of commerce, such as waterways and railways, certain lines of industry such as light manufacturing, tailor shops, drug staples and toilet specialty manufacturers, printing establishments, etc., have a tendency, however, to encroach upon residence and commercial districts for two reasons. First, to be within easy riding or walking distance from the homes of their employees; Second, an economic reason, on account of the low rent or puchase price of the property they occupy. On certain retail business streets the shops on the ground floor command very large rents while it is impossible to attract shoppers to the upper floors. These upper floors are given over to less attractive industries at attractive rentals.

In the building up of a residential district the first comers select the better locations, the latter comers taking what is left. In the beginning there is a tendency to keep away from street car lines and railroad lines. Corners are shunned in many cases. As time passes this tendency leaves unimproved a number of lots, sometimes four or five of them adjoining each other.

A group of four or more vacant lots adjoining each other in a residence district is always a menace, as their purchase is readily accomplished. This is not always the case in an old neighborhood where prices are high and a separate transaction must be conducted for each lot, titles cleared, missing heirs located, and possible hold-up tactic of one or more owners contended with.

Regulating the height limit of buildings supplements the restrictions of use in residential districts, as store buildings very detrimental to the district could be built under ordinary residence limitations large enough to serve their purpose. Tall apartment buildings are prohibited by this means from one and two-family house districts.

The height restriction serves its chief purpose as applied to business and commercial buildings. As previously noted this development is along streets mostly used for travel by the public. Where two or more such streets converge or cross a similar street there is an especially desirable location for several blocks or squares such as in the downtown district of a city. Here there is always a tendency to exploit the location to the greatest extent. Concentrated grouping of high buildings for retail department stores, office buildings, theaters and hotels makes the district grown upwards instead of spreading out, and as a result conditions of congestion occur with the attendant transportation and other public service problems.

The permissible height of a building is generally regulated by one of two methods. One is to allow a building to be built a certain number of times the width of the street it fronts on, the ratio varying in different districts, the other is to allow a uniform height limit for each district disregarding street widths.

The percentage of the area of a lot that may be covered by buildings varies in the different districts. In the industrial districts 100 per cent is generally allowable. In the commercial and business districts nearly 100 per cent is allowable, varying with the height of the building. Apartment districts, 75 per cent generally, and in residential districts it is usually restricted to about 30 per cent.

In dividing a city into zones a careful study should be made of existing conditions; the tendencies of present occupation and the possibilities of ultimate development. It must be borne in mind that the property of a city depends upon its industries and upon its business and commercial houses. Provisions, therefore, must be made for the development of those in existence and the acquirement of new industries if the city is to grow.

As residence and business houses will not mix successfully, provision must be made for residential districts and their preservation as such if orderly growth is to follow. The growth of our cities has generally been haphazard. The central or business district has a fringe of factories around it, skirted with residences on the outside of the factories. Factories, industrial plants and business streets extend into the territory occupied by residences, causing large numbers of the residents to move out, leaving a blighted district in its trail. It finally gets out far enough and requires so much time in travel that it is sometimes more convenient to live in the suburbs and use the railroad than to live in the city and depend on the street cars. Only dense population and over congestion can support a rapid transit line. This develops tenements and tends towards the elimination of the private home in cities.

It may be asked that if a city like Chicago had been zoned in the early period as a small city would it have become a large city? The answer is yes, but the development probably would be along radial lines instead of concentric rings. In all probability a high class residence district with park and boulevard systems would have extended along the entire lake front, the commercial districts would have extended along North Clark Street, Milwaukee Avenue, Madison Street, Archer Avenue and State Street; the industrial districts would have lined the river banks and the railroads and the residential districts would have been much closer to the heart of the city.

Much can be said on the subject of skyscrapers and their effect on a city's growth, but as a lengthy discussion cannot be included in this report, let it suffice to call attention to the fact that a city must have attained a certain growth, a certain amount of local transportation terminals and a certain importance on railroads or waterways before anyone would be justified in erecting a skyscraper, and at this very point is the time for the city to determine as to its best policy, whether to concentrate or whether to restrict height and spread out; whether to adopt a comprehensive city plan to govern its ultimate development.

The successful zoning law will be the one that receives the intelligent and unsefish support and co-operation from the major portion of the citizens. To accomplish this it must not be burdensome, confiscatory or oppressive, and must be capable of amendment, but not easily so.

Therefore when a zoning law for cities is framed they must not be done along the lines of a reconstructive plan or as a cure-all for such existing conditions as are an argument for its need, but rather as a plan of future development. Such residence districts as are now in existence should be amply protected even though there are a number of non-conforming occupations within their boundaries. A limitation should be set on the height to which future buildings can be built and this should be varied with the use of the various districts.

Sewers, Water Supply and Other Service Utilities.

The street layout having been studied in connection with the modern accepted idea as to lot occupation and use, the question of drainage, water supply and similar utilities will be of comparatively simple solution. They will be planned and built but once, will rarely become obsolete, will be neither underbuilt or overbuilt, and their useful life should be vastly increased. The saving to the public would without doubt run into hundreds of millions of dollars in the course of generation.

Public utilities can generally adapt themselves to the zone plan rather than desire, expect or require that the zone plan be modified to meet their special conditions.

In so far as the zone plan tends to stabilize conditions and to prevent changes from residence to manufacturing or to retail business; or from cottages to apartment hotels, it will tend to aid the utilities by lessening costs and increasing efficiency of use of their plants.

If the zone plan could group all non-users of a utility in one section, and lead to high development of use in all other sections, it would also lessen average costs and increase efficiency. It can't do this, but will have a somewhat similar effect.

If a city were laid out primarily to aid the distribution of water, gas, electric light and power, transportation and telephones, open spaces such as parks would be eliminated; large users of service would be located near the economical centers of supply, the smaller users being arranged around them in circular zones, and the main streets would be generally radial from such centers to other centers rather than parallel to each other as in Chicago today. Some of these features are good in any event, but in general they would be adopted for other reasons than to aid the utilities directly.

The general street and alley plan and the density of service development in various areas are the two elements of a city which directly affect the plant and unit costs of each utility.

There are two items in regard to which a zoning law might have an unfortunate effect on a utility which must have local distributing centers at or very near *calculated* locations.

First, If a telephone distribution center (or operating office) were so classified by law as to prevent its occupying the economical wire center that it should and does today occupy, then telephone costs will be rather largely increased. However, as a telephone office is not undesirable even in a residence neighborhood, this result need not be anticipated.

Second, Unless the zoning plan is permanently retained approximately as first adopted, the distributing plant of utilities may suddenly be thrown all out of balance by a change of plan. This should be recognized when changes are suggested.

September 5, 1920

THE STREET SYSTEM.

Such information as is available points unanimously to the conclusion that before any comprehensive scheme of zoning is adopted the street system must be adopted. Chicago already has the Chicago plan along these lines, but while this is a good start it is not sufficient. The problem must be studied in great detail in connection with occupation, and outside or regional planning. If this is not carefully done it will be impossible to determine the probable development of a district, and may result in injuring property instead of helping it.

In Chicago's case the problem is relatively simple. The topography is flat, on one side is Lake Michigan, and the Chicago plan has already made a wonderful start. However, many districts have been blighted because of inadequate street planning and the choking of the downtown district with terminals and surface transportation.

While not much can be done towards the rejuvenation of blighted districts until remedies have had time to become somewhat effective, still they may be kept from getting worse, and a proper zoning ordinance will in time vastly increase their values. This has been the experience of New York particularly which in reality is the pioneer in this movement.

Nearly all the surrounding municipalities near Chicago are discussing the question, and in some cases have taken steps in that direction. The danger is that they will proceed without detailed and expert study and full hearing and consideration and will receive a setback through an adverse court decision that will cripple accomplishments in Illinois.

Recommend to the Council and ordinance, which having been adopted by the Council, will result in an official authoritative "Zoning" or districting plan for the entire city in the interest of the health, safety, comfort and general welfare of all its citizens with discrimination.

Respectfully submitted,

R. E. SCHMIDT,
A. P. ALLEN,
R. W. KNIGHT,
CHAS. K. MOHLER,
PAUL E. GREEN, Chairman.

TERMINAL RAIL *and* WATER COMMITTEE

J. R. BIBBINS, Chairman

Supplementing the Journal's last report on the activities of this committee (July 20th number, pages 16 and 26), the membership will be glad to know that as the result of the committee's Spring activities, the Chicago Convention program of the American Association of Port Authorities, to be held in the Hotel Sherman, September 30th, October 1st and 2nd, has been considerably enlarged to include Chicago representation.

As a result of the committee's work the Port Authorities' executive committee have invited the president of the Western Society of Engineers and the Society of Mechanical Engineers to take charge of one of the sessions, a courtesy which our Society should appreciate.

The technical work of the committee being completed, the entire Chicago program has been assumed by a committee appointed by the Mayor, A. W. Dilling, Secretary.

In addition to the list of out-of-town speakers, there will be the following addresses, dealing more or less with the technical features:

Col. John Millis, U. S. A., "Nature's Preparation for Deep Water Harbors on the Great Lakes."

Theodore Brent, Federal Manager, Mississippi-Warrior Waterways, "The Need of Water Terminals for Chicago."

H. C. Gardiner, President, Great Lakes-St. Lawrence Tidewater Association, "The Coming Need for Terminals for Large Vessels at Great Lakes Ports."

Ross A. Woodhull, Chairman Rivers and Harbors Committee, "Chicago's Problems as a Port."

J. R. Bibbins, "Economic Lines of Gravitation of Overseas Freight Movement from the Mississippi Basin."

M. G. Barnes, Chief Engineer Illinois Canal, "Lake and Barge Terminals for Chicago."

Col. H. C. Boyden, Engineer, Portland Cement Association, "Recent Researches in Concrete for Marine Terminals."

Wm. G. Artingstall, formerly engineer Harbor Board, "Technical Features of the Chicago Harbor."

The outstanding subject of this convention, from the Chicago standpoint will thus be the matter of terminals, than which no more important point can possibly be discussed at this convention.

July Building Figures Show Decrease

A falling off of building operations for the territory east of the Missouri and north of the Ohio rivers is reflected in the July building figures compiled by the F. W. Dodge Company in the *American Contractor*. A twenty-one per cent decline from June figures is noted. Building conditions in 1920 have been without a precedent in the past, says this company. In 1919 July was the month that showed the largest amount of work started, whereas this year the July figure is lower than that for any previous month.

EMPLOYMENT SERVICE

Do you need assistants?

Do you want a position?

Do you feel that you have men in your employ that are needed more in some other position?

Do you wish a change or advancement? The service we render is to bring men together for their mutual benefit. In order to do this, we offer free of charge, this Employment Service. Will you use it?

Positions Available

A-70: WANTED—STRUCTURAL designer with mech. experience; familiar with coal and ore handling machinery; salary $250 per month.

A-71: GRADUATES WHO DESIRE to connect with a large manufacturer of miscellaneous electrical household appliances; located in Chicago, Ill. We need four men from 1919 or 1920 graduate class who are ready to spend one or two years learning the details of engineering, sales, production or manufacturing department.

A-72: WANTED — MECH. ENGINEER to take entire charge of mech. department of large industrial engineering firm in Chicago; thorough knowledge of power plant, heating, plumbing, ship equipment, etc.; salary, $5,000 to $10,000.

A-73: WANTED — ENGINEER with experience on the design of machinery and plant layouts, to take charge of the Engr. department of medium sized manufacturing plant near Chicago; location ideal.

A-74: WANTED—MEN ABLE to handle inspection work on building construction and also to be available for building and mechanical drafting.

A-75: INSTRUCTORS IN VARIOUS departments of well known state university; vacancies in architectural, civil engr., electrical engr., mech. engr., theoretical and applied mechanics, physics and railway mech. engr. departments; salaries, $1600 to $1800 for 10 months, depending upon qualifications of candidate.

A-76: APPLICATIONS WILL be received for first-class building superintendents for project at Memphis, Tenn. Must be young men, thoroughly competent and accustomed to reinforced concrete buildings; be able to lay off work; be up-to-date in form construction and capable to take entire charge of a building throughout.

A-77: MECHANICAL ENGINEERS and draftsmen wanted for designing and detailing conveying machinery both in Chicago and Louisville.

A-78: WANTED—A LIVE, ALERT young man with reasonably thorough technical training in addition to practical experience for taking off quantities of different materials, occasionally making a layout and such general work as this might entail. A good opportunity for advancement is offered. Work at Memphis, Tenn.

A-79: POSITION OPEN AS REFRIGERATING sales engineer to manage Chicago office of reliable company.

A-80: CHICAGO CONCERN REQUIRES services of an experienced man on chemical plant construction

Positions Available—Continued

and operation. This position involves building and starting a potash plant in So. Calif. Nature of work requires a man with at least 10 years' actual experience and salary will be paid in accordance with ability.

A-81: RAILROAD COMPANY wants draftsman with knowledge of structural design and track.

A-82: RAILROAD CO. WANTS young engineering graduate to travel out of Chicago. Expenses allowed when on road, away from city.

A-83: RAILROAD CO. WANTS 4 engineers on valuation work familiar with structures and foundations.

A-84: INDUSTRIAL CONCERN wants engineer to sell service of their company. Experienced as contract agent preferred.

A-84: ENGINEERING CONCERN in Chicago wants:

- Reinforced concrete designer.
- Mech. designers, h. p. steam.
- Young man to learn business beginning with arch. work.

A-85: FOUR A-1 MECH. DRAFTSMEN, familiar with piping of shops and roundhouses. Good position for temporary work.

Positions Wanted

B-700: MECH. ENGINEER specializing in machinery design, factory maintenance, extension, investigations and reports; available for such work on part time basis.

B-701: GRADUATE MECH. ENGINEER, best references, open for power plant, testing and electrical engineering; technical writing or sales engr. work.

B-702: A-1 STRUCTURAL ENGINEER and designer open for position in Philippine Islands or other foreign work; married; will consider two-year contract with expense for moving.

B-703: CORNELL GRADUATE, C. E. 1919, with experience in surveying and construction, wants position, preferably with railroad terminal construction project.

B-704: ENGINEER NOW EMPLOYED; having experience: railway location and foundation work, Ry. construction, fixed and movable bridge design and construction; major with Canadian railway troops overseas; open for position where he can make use of his experience as executive and handling men; salary, $5,000; best references.

B-705: FIRST CLASS DRAFTSMAN desires work on construction details for private parties.

B-706: GRADUATE MECH. ENGINEERING Univ. of Wisconsin, with especial qualifications along steam and gas engineering lines available for position in such work.

B-707: DESIGNER ON CONCRETE and industrial buildings and estimator who can take care of office work and who is familiar with sub-contracts in above work, desires outside work; eight years experience; best references.

B-708: ENGINEER, AGE 45; married; with good technical education, having broad general experience; thoroughly familiar with construction work, surveying, drafting room practice, machine design and shop practice, including actual operation of various machine tools; has done research work on clay products and smelter practice; will consider position as chief engr. or supt. of construction on construction work or manufacturing plant; salary, $5,000; best references.

B-709: GRADUATE C. E., Northwestern University has had experience in general construction work, road construction and was asst. engr. of large city; desires position as supt. of construction; designer, structural steel or reinforced concrete, or as estimator.

B-710: MECHANICAL ENGINEER, age 35, technical education, thorough knowledge of the designing of power-plants, heating, ventilating, plumbing and fire-protection; can take entire charge of mechanical department of an architectural or engineering firm, including the making of plans, specifications, estimates, reports and the superintending and testing of installations; best references.

B-711: GRADUATE U. S. A. TOPographical School F. A. R. D. Thorough training in topographical work, railroad map and municipal drafting, seeks position along above lines.

B-712: CHICAGO LICENSED ENgineer. Broad experience in engine construction, mining machinery, motive power and equipment, hydraulic power and equipment. Best of references.

B-714: MECH. DRAFTSMAN, 3½ years' experience detailing, tracing, layouts and machine designs wants position in similar work.

B-715: PROFESSOR ELEMENTary mathematics wants position teaching elementary math., plane surveying or elementary physics. Night classes only.

B-716: GRAD. M. E. ARMOUR Ins., experienced designer of machinery, plant layout, etc. Production engineer of plant with machine shop, steel furniture shop, paint, electrical surgical inst. depts. wants position as (1) production engr., efficiency engr. or asst. supt.

B-717: RELIABLE YOUNG MAN open to position as rodman, instrumentman or chainman.

B-718: CAPABLE C. E. GRADUATE desires to make connection with commercial engineering concern where his experience will be beneficial. Best of references.

B-719: THOROUGHLY COMPEtent engineer open for position as genl. supt., shop mgr., mfg. machy. along following lines: Steam, gas, steel and iron, marine turbines, reciprocating, ice refrigeration, valves and fittings, heavy and light.

B-720: GRADUATE C. E., 18 years' exp. leading bridge and railroad companies wants position with bridge work in office or field.

B-721: GRAD. U. OF WIS. 1910 elec. eng., exp. testing, power maintenance departments wishes position with industrial plant as (1) power and maintenance, elec. (2) asst. to supt. power or (3) elec. engr.

B-723: ENGINEER ON HARBOR structures, foundations, steel and concrete structures of all kinds, familiar with design and details of construction of buildings and other structures wants position as designing engineer, squad boss, chief draftsman, estimator or supervising engr., preferably in contractor's office.

B-724: ENGINEER WITH EXPErience in power plant operation and design, industrial plant design and conveying machinery. Open to position in similar work.

B-725: TECH. H. S. GRADUATE. Desires apprenticeship in civil or mech. engrg.

B-726: TECH. H. S. GRADUATE. Open to work along civil or mech. engrg. lines.

B-727: ENGR. HAVING EXPERIence as chief draftsman, mech. engr. and shop supt. of large mfg. concern desires position as (1) mech.

Positions Wanted—Continued

engr., (2) shop supt. or (3) designer of machinery and power plants.

B-728: MAN HAVING STRUCTURAL engineering experience desires position along structural lines.

B-729: YOUNG MAN DESIRES temporary position as surveyor or other civil engineering work where his experience could be utilized.

B-730: MECH. ENGR. HAVING manufacturing experience in executive positions wants position as (1) sales engineer, (2) factory superintendent or (3) production engineer.

B-731: A-1 ENGINEER FAMILiar with theory of deflection, continuous girders, swing bridges, arches, suspension bridges and secondary stresses. Also special problems in intermediate structures with the slope deflection method. Desires to become associated with responsible firm.

B-732: TECH. GRADUATE, three years' experience, wants position as structural draftsman.

TECHNICAL SECTION

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Hydraulics of the Chicago Sanitary District's Main Channel

By MURRAY BLANCHARD, M. W. S. E.,
Formerly Assistant Engineer to the Sanitary District of Chicago.

INVESTIGATION of the flow of the Main Channel covering a period of three years, 1914-1916 and part of 1917, was made for the Sanitary District of Chicago by the writer.

This involved a series of current meter measurements extending over the entire time, which period was required in order to obtain a sufficient range in the stage of Lake Michigan in connection with the varied stages at the Lockport Power House, to give a variety of conditions of uniform flow from which a law of flow in the rock section below Willow Springs could be derived.

The channel receives its water from Lake Michigan and it discharges through a power house and over a set of dams and controlling works at Lockport, Illinois. The total length, including the Chicago River, is 36 miles.

There is no storage reservoir at the power house and consequently the water in the channel above is considerably drawn down during the night time, especially when the peak load is carried. It becomes necessary, therefore, to build up the head each day. This is done by raising the movable crests of the regulating dams at the outlet.

Difficulty was encountered in maintaining, over several hours, a uniform flow in the stretch under consideration and a great many discharge measurements because of a slight rise or fall in the stage occurring during the observations were rejected.

On account of the many disturbing elements, the great length of channel and the flat slope, extraordinary precautions were taken to eliminate as far as possible all sources of error. A change in the fall of 1/10 foot in the seven mile stretch from Willow Springs to Lemont corresponds, practically, to a change in the discharge of 800 c. f. s., or 16%, when there is a flow of 5,000 c. f. s. and to a change in the discharge of 600 c. f. s., or 6%, when there is a flow of 10,000 c. f. s. This shows the refinements required to obtain a high degree of accuracy. Most of the methods developed by the U. S. Lake Survey in the gagings of the connecting channels of the Great Lakes were adopted and the more recent improvements found in the facilities for the rating of current meters in the naval tank of the University of Michigan at Ann Arbor, Michigan, were used.

When the first series of measurements, made during the summer of 1914, were compared with the series made in 1915, the discharge curves indicated a slight seasonal difference. Hence it was also to obtain a check on the work done and to make certain that there was sufficient data collected from which to draw reliable conclusions that the third series of measurements were made in 1916 and completed early in 1917.

SPECIAL FLOW MEASUREMENTS.

A number of measurements (Fig. 1) were made on Sundays, when, because of the light load at the power house, it was possible to maintain, for a longer time, a uniform flow in the rock section. On week days it was necessary to utilize a large portion of the time in building up the head for the following night.

Special measurements of the flow were made, as required, to obtain data for various purposes, such as a continuous run of meters for 24 or 48 hours under working conditions when the flow was non-uniform, for a comparison with the power house flow under conditions of both rising and falling stages, and also to observe the simultaneous flow through the Chicago River and the Main Channel.

METER RATING.

The current meters used in the discharge measurements were rated periodically at Ann Arbor, Michigan, in the Naval Tank of the University of Michigan.

For the purpose of comparing the "screw" and "cup" types of meters, they were run simultaneously side by side on the Lemont section and also rated simultaneously in the tank.

ROD FLOAT OBSERVATIONS.

Experiments with rod floats were made, which consisted of a series of measurements of the discharge at Lemont simultaneous with current meter determinations, and also of observations with rods of various lengths run across the section between and alongside of two current meters running at fixed positions, generally ten feet apart.

WATER LEVEL OBSERVATIONS.

Particular attention was given to the matter of water level determinations and in this connection self registering gages were installed. These instruments give a continuous record of the stage for the 24 hours of the day, but their chief function on stream gaging is to eliminate erroneous gage readings obtained by careless observers. These gages are not infallible and in order to determine what degree of accuracy could be expected on some of the earlier work, gage readers were stationed at the self registering gages (although not having access to them) and took readings on the reference gages while the discharge measurements were in progress.

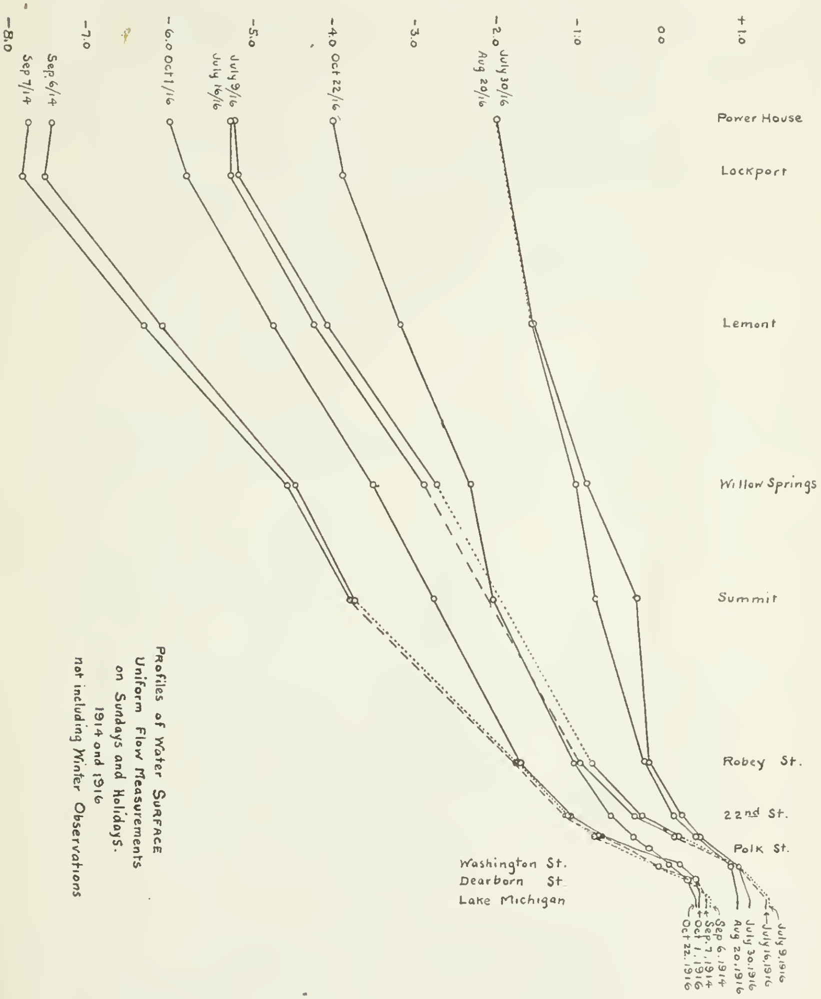


Fig. 1

When the individual readings and the mean of a series of readings checked the self registering gage record, the results were considered reliable.

NOTATION.

q—Observed Discharge in sec-ft.
Q—Corrected Discharge Observation.

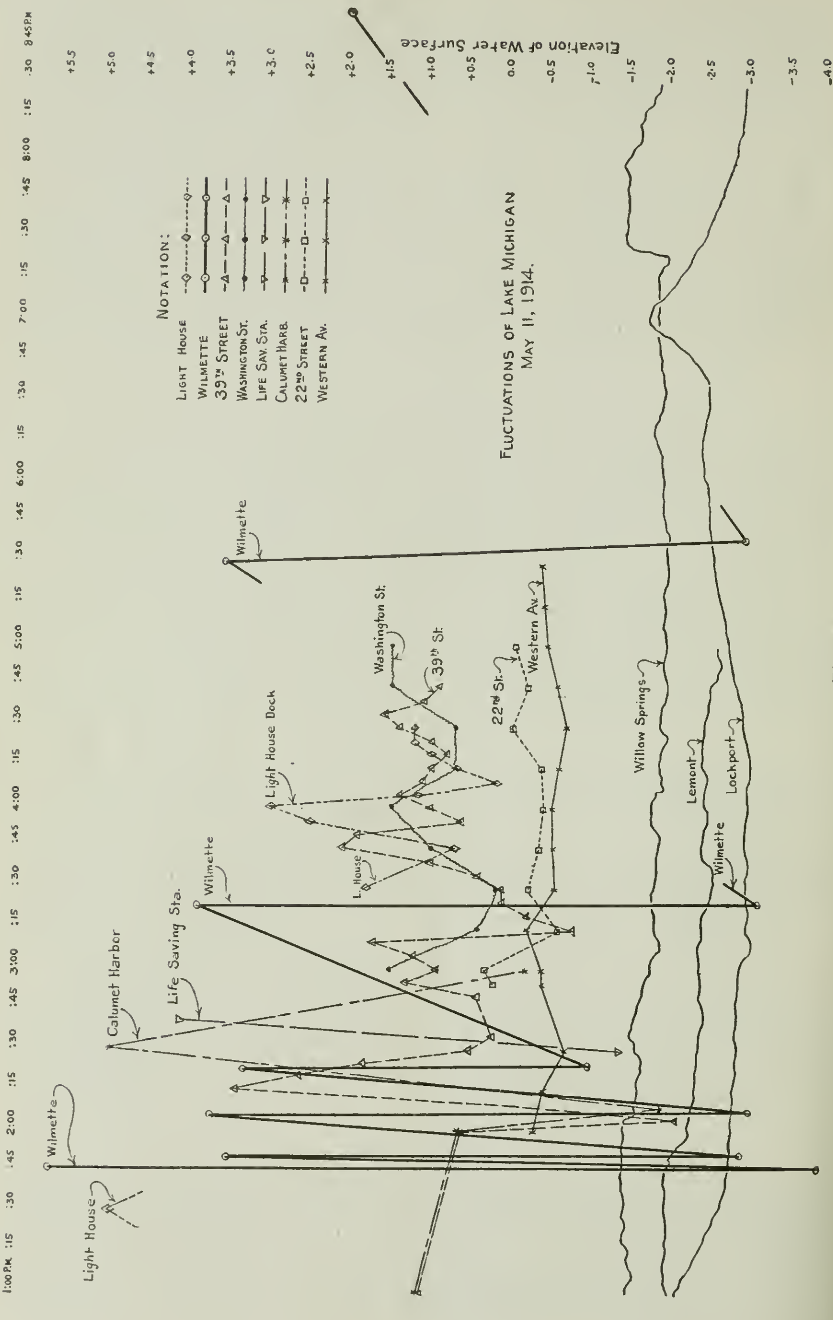

Fluctuations of Lake Michigan
May 11, 1914.
Notation:
Light House
Wilmette
39th Street
Washington St.
Life Sav. Sta.
Calumet Harb.
22nd Street
Western Av.
Elevation of Water Surface
+5.5
+5.0
+4.5
+4.0
+3.5
+3.0
+2.5
+2.0
+1.5
+1.0
+0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
-3.0
-3.5
-4.0
1:00 P.M.
:15
:30
:45
2:00
:15
:30
:45
3:00
:15
:30
:45
4:00
:15
:30
:45
5:00
:15
:30
:45
6:00
:15
:30
:45
7:00
:15
:30
:45
8:00
:15
:30
8:45 P.M.
Light House
Wilmette
Calumet Harbor
Life Saving Sta.
Wilmette
L. House
Light House Dock
Washington St.
39th St.
22nd St.
Western Av.
Wilmette
Willow Springs
Lemont
Lockport
Wilmette

Fig. 2

a—Partial Area of Cross Section.
A—Area of Cross Section.
R—Hydraulic Radius.
v—Observed Velocity in sec-ft.
V—Corrected Velocity in sec-ft.
e—Observed Elevation of Water Surface in feet below Chicago Datum.
E—Corrected Elevation of Water Surface in feet below Chicago Datum.
F—Fall in feet between two stations.
C. C. D.—Elevation of Chicago City Datum (580.01 feet above Mean Tide at New York).
I—Index Point of a Discharge Section.
L—Length of a Uniform Stretch.
S—Slope of the Water Surface in feet per foot.
C—Coefficient or Constant Quantity.
H—Head in Feet.
W—Width in Feet.

Subscript 1 refers to Lemont.	Q_1, R_1, E_1, V_1, A_1.
Subscript 2 refers to Willow Springs.	Q_2, R_2, E_2, V_2, A_2.
Subscript 3 refers to Lockport.	Q_3, R_3, E_3, V_3, A_3.
Subscript M refers to Av. Lemont & Willow Springs.	Q_M, R_M, E_M, V_M, A_M.
Subscript m refers to Mean.	Q_m, R_m, E_m, V_m, A_m.
Subscript 1 refers to Station Number.	q_1, r_1, e_1, v_1, a_1.
MK refers to Mean for a constant slope.	

ABNORMAL LAKE FLUCTUATIONS.

Two abnormal fluctuations (known as seiches) of Lake Michigan were observed. They accurred on May 11, 1914, and May 19, 1917. Their duration is so short that the main channel flow is not materially affected by them. (Fig. 2.) When the second seiche occurred, a self-registering gage had been established on the lake front at the mouth of the Chicago River. The graphic record is shown on Figs. 3 and 4. On the latter are also shown monthly and annual fluctuations of the lake.

FLOW FORMULÆ.

The conditions of uniform flow encountered were different from those where the common flow formulæ are applicable. The difference lies in the fact that in the main channel we have, for any hydraulic radius, (R), a variety of slopes with their corresponding velocities and discharges. The reason for this is that Lake Michigan assumes various elevations in conjunction with which high and low stages at the Lockport power house are obtained by operating the controlling works.

Ordinarily in streams there is only one condition of uniform flow for each stage and the discharge increases with the gage height while the slope change is comparatively small. The case of the main channel is more complex, and for the purpose of determin-

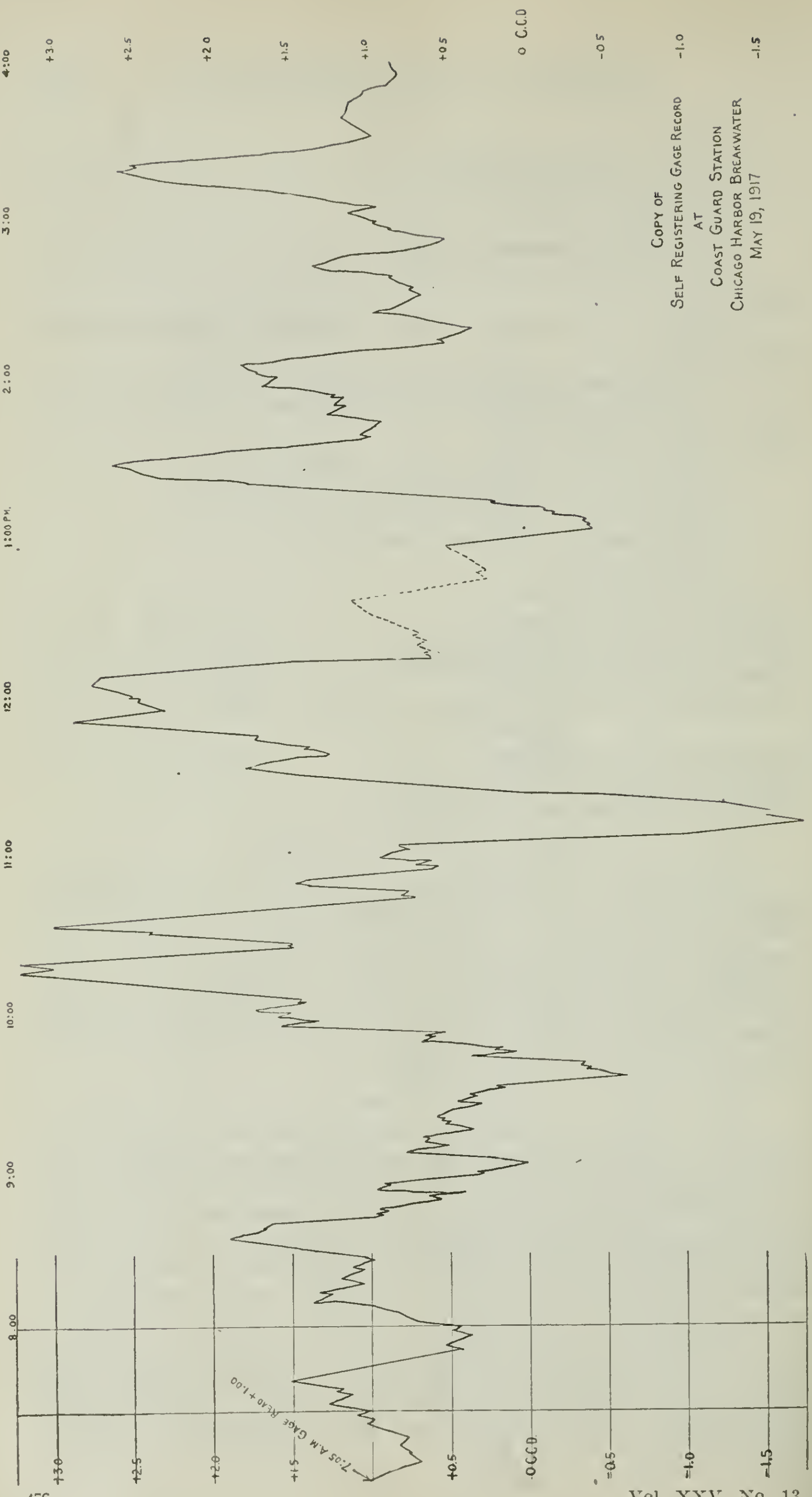

COPY OF
SELF REGISTERING GAGE RECORD
AT
COAST GUARD STATION
CHICAGO HARBOR BREAKWATER
MAY 19, 1917

Fig. 3

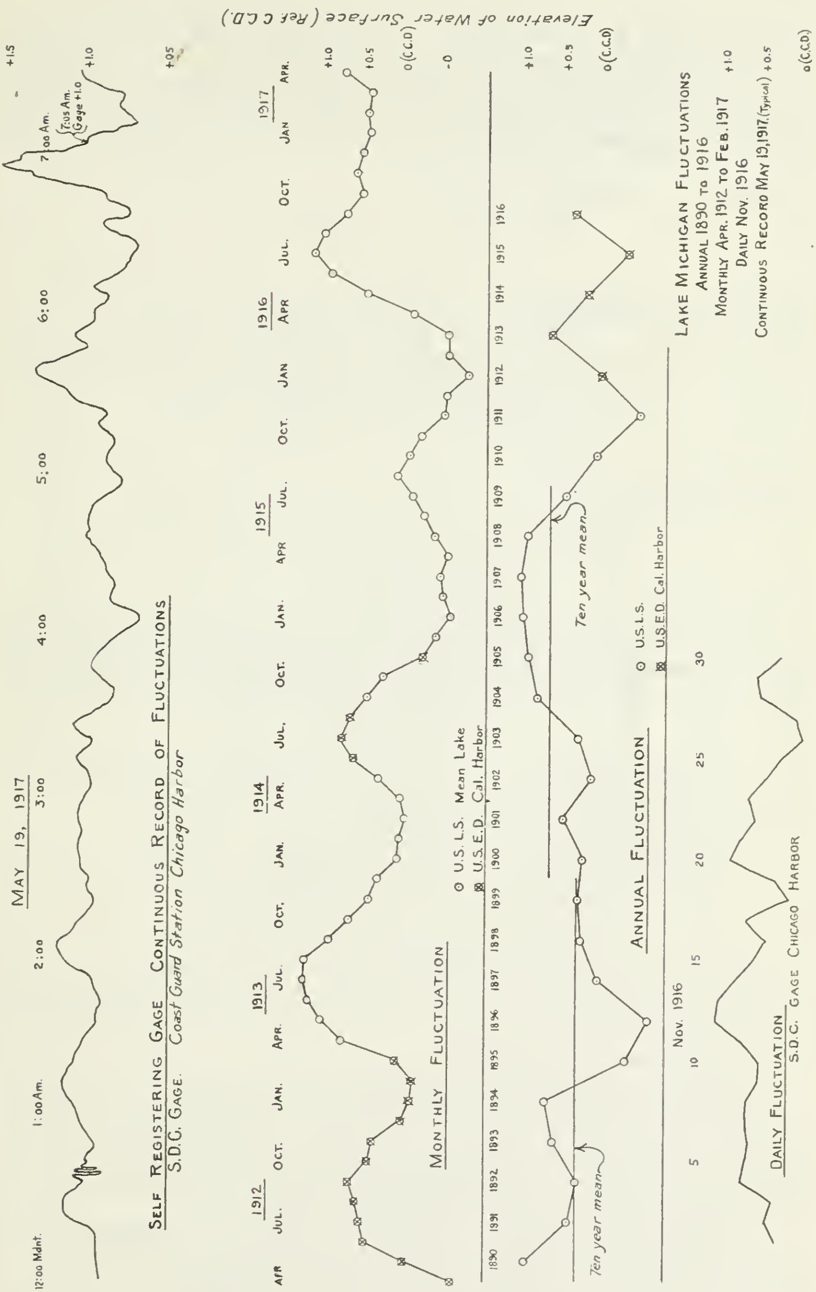

Lake Michigan Fluctuations
Annual 1890 to 1916
Monthly Apr. 1912 to Feb. 1917
Daily Nov. 1916
Continuous Record May 19, 1917. (Typical)
Elevation of Water Surface (Ref. C.C.D.)
Self Registering Gage Continuous Record of Fluctuations
S.D.C. Gage. Coast Guard Station Chicago Harbor
May 19, 1917
12:00 Mdnt.
1:00 Am.
2:00
3:00
4:00
5:00
6:00
7:00 Am.
7:05 Am. Gage +1.0
+1.5
+1.0
+0.5
Monthly Fluctuation
1912
1913
1914
1915
1916
1917
Apr.
Jul.
Oct.
Jan.
+1.0
+0.5
0 (C.C.D.)
-0
U.S. L.S. Mean Lake
U.S. E.D. Cal. Harbor
Annual Fluctuation
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
Ten year mean
Ten year mean
U.S.L.S.
U.S.E.D. Cal. Harbor
+1.0
+0.5
0 (C.C.D.)
Daily Fluctuation
S.D.C. Gage Chicago Harbor
Nov. 1916
5
10
15
20
25
30
+1.0
+0.5
0 (C.C.D.)

Fig. 4

ing the effect on the velocity of a varying hydraulic radius, a constant slope was considered. This assumed slope was an average value for the range of observations.

A formula for uniform flow in the rock section of the main channel was deduced from the observations listed in Figs. 5, 6 and 7. It is an equation of the form

$$y=mx^N$$

which in its logarithmic form is

$$\log. y = \log. m + N \log. x$$

where

$$y = V_M \text{ and } x = s$$

which substituted give

$$\log. V_M = \log. m + N \log. s$$

log. m varies as the mean hydraulic radius R_{MK} for a constant slope (taken as .00001585, the log of which is 5.2000) thus

$$\log. m = k + n \log. R_{MK}$$

in which $R_{MK} = \frac{R_1 + R_2}{2}$ for the constant slope, substituting log. m gives

$$\log. V_M = (k + n \log. R_{MK}) + N \log. s$$

from which is obtained

$$V_M = C\ R_{MK}{}^n s^N$$

GAGE HOUSES.

Shacks about 8 feet square were erected along the main channel for housing the self-registering gages and for sheltering the gage readers and observers on current meter work.

BENCH MARKS.

Permanent benches are established by the U. S. Government along the main channel.

At Lockport, U. S. P. B. M. 111,
At Lemont, U. S. P. B. M. 115,
At Willow Springs, U. S. P. B. M. 120,

were used in referencing the self-registering gages.

REFERENCE BARS.

Permanent reference marks were established at each of the self-registering gages. They are 2-inchx2-inchx24-inch iron bars set horizontally and leaded into the vertical face of the channel wall. (Fig. 8.)

SELF-REGISTERING GAGES.

Those used were of two types, the one making a continuous graphic record of the elevation of the water surface and the other printing the elevations at periodic intervals. The former were installed at the ends of the gaging stretch, where the most accurate determinations of the water surface are required.

One was manufactured by Keuffel and Esser Company and is known as the Coast Survey gage. The other was a Haskell gage, manufactured by L. Wohnlich of Detroit, Michigan.

The printing gage has the advantage of running for a long

Obs No	Date	Wind		Elevation of Water Surface ref C.C.D								Fall in feet						Discharge in cubic feet per second Uniform Flow			Relative Discharge ref. to Chart = 100%	
		Dir	Force	Lake Mich	Westn Ave	Sag Canal (interp) (W Spr. to Lem)	Willow Spring	Lemont	Lockp't	Control Works	Power Ho	Lake to W Ave	W Ave to Lemont	Lake to W.Sprg	W.Sprg to Lemont	Lemont to C.W'ks	Lemont to Lockp't	Current Meter Lemont	Chart 180 Lem. to W.Spr.	Power House L = 617 c.f.s	Meter	Po.Ho L = 617
	1914																					
1	Apr 2			+0.05	-1.87		-4.15	-518	-5.63	-5.84	-592	192	331	4.20	1.03	0.66	0.45	7490	7450	6950	101.5	93.3
7	18			+0.11	-0.84		-2.17	-2.59	-2.98	-2.92	-2.97	0.95	1.75	228	0.42	0.33	0.39	5760	5750	5155	100.0	89.8
11	21	S.	Str	-0.16	-1.30		-2.60	-2.99	-328	-328	-3.33	1.14	1.69	2.44	0.39	0.29	0.29	5750	5200	5430	110.5	104.5
18	May 4	S.E.	Light	+0.33	-1.04		-2.63	-3.21	-368	-3.60	-360	1.37	217	2.96	058	0.39	0.47	7600	6700	6890	1134	102.8
19	6	S W	Str.	+0.17	-1.14		-2.72	-334	-3.85	-3.68	-3.70	1.31	220	2.89	062	0.34	0.51	7430	6900	7025	107.7	101.8
20	6	S.W	Str.	+0.18	-1.14		-2.61	-322	-3.73	-3.61	-363	1.32	2.08	2.79	0.61	0.39	0.51	7280	6900	6805	1054	987
23	19	S.		+0.31	-1.18		-270	-337	-390	-3.83	-3.78	1.49	2.19	3.01	0.67	0.46	0.53	7420	7250	6830	102.2	94.2
24	19	S.		+0.29	-1.08		-2.47	-306	-354	-3.44	-3.43	1.37	1.98	2.76	0.59	0.38	0.48	7460	6950	6980	107.2	100.3
32	Jun 6	S.E.	Light	+0.70	-0.79		-2.11	-2.69	-3.11	-3.05	-308	1.49	190	2.81	0.58	0.36	0.42	7660	7250	6920	105.7	95.5
33	9	S.E.	Str	+0.45	-1.06		-2.58	-3.26	-3.73	-3.67	-3.69	1.51	220	3.03	0.68	0.41	0.47	7930	7300	7250	108.7	99.4
34	10	N.W	Light	+0.45	-1.44		-3.14	-3.95	-4.52	-4.50	-4.50	1.89	251	3.59	0.81	0.55	0.57	8090	7550	7710	107.0	102.1
35	11	S.W		+051	-1.10		-2.69	-3.37	-3.88	-379	-3.80	1.61	2.27	3.20	0.68	0.42	0.51	7860	7300	7380	107.6	101.1
39	15	N.W.	Light AM Str PM	+0.61	-0.92		-2.41	-312	-369	-3.57	-3.60	1.53	220	3.02	0.71	0.45	0.57	7770	7800	7510	99.6	96.4
40	16	S.W	Str	+064	-1.01		-2.50	-318	-3.71	-360	-3.60	1.65	2.17	3.14	0.68	0.42	0.53	7810	7500	7350	104.1	98.0
43	18	S.	Light	+0.58	-1.08		-2.50	-315	-3.61	-3.50	-3.52	1.66	2.07	3.08	0.65	035	0.46	7560	7350	6880	102.9	93.6
44	19	N-NW	Very Str.	+0.95	-0.87		-2.44	-3.21	-375	-370	-370	1.82	2.34	339	0.77	0.49	0.54	8340	8100	7710	102.9	95.3
47	25	N.W	Light.	+0.37	-0.42		-1.45	-1.83	-205	-2.02	-2.00	0.79	1.41	182	0.38	0.19	0.22	6530	5950	5845	109.9	98.2
49	30	S.W.	Light	+0.72	-027		-1.23	-1.63	-1.87	-1.82	-1.81	0.99	1.36	1.95	0.40	0.19	0.24	6900	6500	6225	106.1	95.7
55	Jul 25	S. W.	Light	+0.70	-058		-1.57	-2.06	-2.34	-230	-2.30	1.28	148	2.27	0.49	0.24	0.28	7000	6950	6540	100.5	94.1
56	27	S E-N		+0.67	No Rec.		-1.65	-2.15	-2.46	-2.38	-2.36	—	—	2.32	0.50	0.23	0.31	6980	7000	6780	99.8	96.7
60	29	S E.		+0.82	-0.30		-1.11	-1.54	-1.79	-1.72	-1.75	1.12	124	1.93	0.43	0.18	0.25	7130	6750	6550	105.5	97.0
62	30	S.W.		+0.72	No Rec		-1.46	-1.92	-2.20	-2.15	-2.16	—	—	2.18	0.46	0.23	0.28	7090	6700	6620	105.8	989
65	Aug 4	N.E.	Light	+0.72	-0.35		-1.21	-1.60	-1.88	-1.77	-1.76	1.07	1.25	1.93	0.39	0.17	0.28	6750	6300	6150	107.0	977
72	Sep 6	S.W.	Light	+0.52	-1.79		-4.46	-609	-7.49	-7.36	-7.45	2.31	4.30	4.98	1.63	1.27	1.40	9610	9200	10930	104.3	1190
74	7	N.E.	Light.	+0.52	-1.82		-4.56	-630	-783	-7.64	-7.74	2.34	4.48	5.08	1.74	1.34	1.53	9670	9400	11170	1029	1188
76	Nov 16	W.	Str.	-0.34	-120		-2.12	-2.55	-282	-2.79	-2.80	0.86	1.35	1.78	0.43	0.24	0.27	5430	5850	5080	978	869
	1915																					
81	May 9	W		-0.39	-2.35		No Rec.	-5.02		-5.75	-5.85	1.96	2.67	—	—	0.73		8310	—	8750		
83	13	N.E.	Light.	-0.37	-1.85		-3.10	-3.88		-4.30	-440	1.48	2.03	273	078	042		7500	7500	7210	100.0	96.2
84	14	N.E-E.	Light.	-025	-1.74		-299	-3.75		-415	-425	1.49	2.01	274	0.76	0.40		7550	7500	7060	100.5	94.3
85	15	E.		-041	-1.58		-2.44	-3.05		-3.30	-3.40	1.17	1.47	2.03	0.61	0.25		7090	7100	6670	100.0	94.0
86	17	W.	Light	-0.23	-1.31		-2.19	-269		-2.88	-290	1.08	1.38	1.96	0.50	0.19		6610	6500	6185	101.8	953
87	18	N.E.	Light.	-0.24	-1.85		-3.12	-390		-428	-4.35	1.61	2.05	2.88	0.78	0.38		7610	7450	7085	102.1	95.0

Fig. 5

Obs. No	Date	Wind Dir	Wind Force	Elevation of Water Surface ref. C.C.D. Lake Mich	Westn Ave	Sag Canal (interp W.Spr. to Lem.)	Willow Spring	Lemont	Lockpt	Control Works	Power Ho	Fall in Feet Lake to W.Av	W.Ave to Lemont	Lake to W.Sprg	W.Sprg to Lemont	Lemont to C Wks	Lemont to Lockpt	Discharge in cubic feet per second Uniform Flow Current Meter Lemont	Chart 180 Lem. to W.Spr	PowerHouse L=617c.fs.	Relative Discharge ref to Chart =100% Meter	Po. Ho L=617
	1915																					
88	May 19	N.E.		-0.14	-1.79		-3.07	-3.81		-4.20	-4.30	1.65	2.02	2.93	0.74	0.39		7600	7300	7140	1040	98.0
91	24	S.W		-0.35	-1.03		-1.92	-2.47		-2.70	-2.75	0.68	1.44	1.57	0.55	0.23		6450	7150	5785	90.3	81.0
92	25	S.W.		-0.25	-1.57		-2.79	-3.52		-3.90	-4.00	1.32	1.95	2.54	0.73	0.38		7430	7500	7100	990	94.6
94	27	E.		-0.11	-1.39		-2.45	-3.02		-3.35	-3.40	1.28	1.63	2.34	0.57	0.33		7130	6800	6810	1049	100.0
95	Jun 1	S.E	Light	-0.15	-1.42		-2.57	-3.39		-3.92	-4.00	1.27	1.97	2.42	0.82	0.53		8260	8250	7630	100.0	92.6
96	2	E.	Light.	-0.10	-1.60		-2.97	-3.88		-4.46	-4.60	1.50	2.28	2.87	0.91	0.58		8210	8300	8090	99.0	97.5
97	4			-0.08	-1.67		-3.21	-4.14		-4.70	-4.85	1.59	2.47	3.13	0.93	0.56		8090	8100	8210	100.0	101.2
98	10	S.E.	Light	-0.42	-1.68		-3.14	-4.01		-4.47	-4.60	1.26	2.33	2.72	0.87	0.47		7820	7850	7150	99.8	91.1
99	11	S.W	Light.	-0.16	-1.67		-2.98	-3.78		-4.28	-4.40	1.51	2.11	2.82	0.80	0.50		8100	7700	7215	105.1	93.8
100	15			-0.32	-1.50		-2.78	-3.51		-3.95	-4.00	1.18	2.01	2.46	0.73	0.44		8080	7500	6760	107.8	90.2
101	16	S.W.		-0.48	-1.86		-3.18	-3.94		-4.35	-4.50	1.38	2.08	2.70	0.76	0.41		7910	7300	7155	108.4	98.2
102	17			-0.12	-1.58		-3.04	-3.95		-4.45	-4.60	1.46	2.37	2.92	0.91	0.50		8500	8200	7580	103.6	92.5
105	25	S.E.	Light	+0.13	-1.28		-2.54	-3.31		-3.67	-3.80	1.41	2.03	2.67	0.77	0.36		8140	7950	7475	102.2	94.0
106	29	N.E.		+0.04	-1.35		-2.62	-3.38		-3.82	-3.90	1.39	2.03	2.66	0.76	0.44		7840	7850	7310	100.0	93.2
107	Jul. 2	S.E.		-0.10	-1.57		-2.90	-3.73		-4.20	-4.30	1.47	2.16	2.80	0.83	0.47		8080	7900	7540	102.2	95.4
108	6			-0.28	-1.60		-2.81	-3.58		-3.92	-4.00	1.32	1.98	2.53	0.77	0.34		7410	7700	7110	96.1	92.3
110	8	N.E.		+0.21	-1.24		-2.37	-3.10	No Gage.	-3.48	-3.50	1.45	1.86	2.58	0.73	0.38		7610	7900	7560	96.4	95.7
111	9	S.E.		-0.12	-1.55		-2.80	-3.53		-3.97	-4.05	1.43	1.98	2.68	0.73	0.44		7430	7500	6955	99.2	92.8
113	13	W	Light	-0.15	-1.46		-2.81	-3.63		-4.08	-4.20	1.31	2.17	2.66	0.82	0.45		7780	7950	7380	98.0	92.8
115	15			+0.03	No Rec		-3.14	-4.06		-4.65	-4.80	—	—	3.17	0.92	0.59		8060	8100	7585	99.5	93.6
116	19	N.W.		+0.19	-1.15		-2.32	-3.09		-3.55	-3.60	1.34	1.94	2.51	0.77	0.46		7840	8200	7335	95.6	89.4
117	20	N	Str.	+0.33	-1.73		-3.34	-4.37		-4.95	-5.10	2.06	2.64	3.67	1.03	0.58		8170	8350	7760	98.0	93.0
118	21	N.W	Light	+0.19	-1.62		-3.14	-4.04		-4.55	-4.70	1.81	2.42	3.33	0.90	0.51		8010	8000	7720	100.0	96.6
120	23	N.E		+0.04	-1.58		-2.90	-3.73		-4.20	-4.30	1.62	2.15	2.94	0.83	0.47		7510	7900	7290	95.2	92.3
121	29			+0.07	-1.06		-1.95	-2.48		-2.71	-2.80	1.13	1.42	2.02	0.53	0.23		6950	6950	6460	100.0	93.0
122	29			+0.23	-0.96		-1.91	-2.46		-2.70	-2.80	1.19	1.50	2.14	0.55	0.24		7330	7200	6650	101.8	92.4
124	Aug 2	N.E.		+0.42	-1.34		-2.85	-3.80		-4.37	-4.50	1.76	2.46	3.27	0.95	0.57		8330	8550	7960	97.5	93.2
126	5			+0.37	-1.08		-2.53	-3.36		-3.90	-4.00	1.45	2.28	2.90	0.83	0.54		7900	8300	7465	95.2	90.0
127	6	W		+0.36	-1.08		=2.55	-3.45		-3.98	-4.10	1.44	2.37	2.91	0.90	0.53		8210	8650	7535	95.0	87.1
	1916																					
129	May 5	S.W.		+0.07	-0.56		-1.40	-1.81		-2.05	-2.05	0.63	1.24	1.47	0.40	0.25		6950	6200	6100	112.0	98.4
130	6	S		+0.06	-0.93		-1.91	-2.50		-2.86	-2.90	0.99	1.55	1.97	0.57	0.38		7390	7300	6290	101.1	86.2
131	8	S	Str	-0.15	-0.75		-1.63	-2.09		-2.30	-2.25	0.60	1.34	1.48	0.46	0.21		6180	6650	5690	93.0	85.6

Fig. 6

Obs. No.	Date	Wind		Elevation of Water Surface ref. C.C.D.								Fall in Feet						Discharge in cubic feet per second Uniform Flow			Relative Discharge ref to Chart = 100%	
		Dir.	Force	Lake Mich	West'n Ave	Sag Canal (interp) (W.Spr. to Lem)	Willow Spring	Lemont	Lockp't	Control Works	Power Ho.	Lake to W.Av.	W.Ave to Lemont	Lake to W.Sprg	W.Sprg to Lemont	Lemont to C.Wks	Lemont to Lockp't	Current Meter Lemont	Chart 180 Lem. to W.Spr.	Power House L=617 c.f.s	Meter	Po. Ho L=617
	1916																					
1.32	May 9	E.	Light	+0.28	-1.00		-1.80	-2.29		-2.60	-2.62	1.28	1.29	2.08	0.49	0.31		7380	6750	6230	109.2	92.3
1.37	16	S.W	Str	+0.32	-0.68		-1.66	-2.19		-2.56	-2.56	1.00	1.51	1.98	0.53	0.37		7440	7250	6130	102.3	84.6
1.38	17	S.W	Str.	+0.37	-0.66		-1.65	-2.22		-2.53	-2.50	1.03	1.56	2.03	0.56	0.31		7680	7600	6200	101.0	81.6
1.39	17	S.W.	Str	+0.49	-0.62		-1.66	-2.22		-2.58	-2.50	1.11	1.60	2.16	0.55	0.36		7440	7500	6570	99.2	87.7
1.42	20	E.	Light	+0.43	-0.70		-1.69	-2.26		-2.67	-2.65	1.13	1.56	2.13	0.56	0.41		7640	7550	6750	101.1	89.4
1.43	22	S.W	Light.	+0.65	-0.43		-1.47	-2.07		-2.50	-2.50	1.08	1.64	2.12	0.60	0.43		7990	7900	6680	101.0	84.6
1.44	22	S.W	Light	+0.73	-0.34		-1.38	-2.02		-2.48	-2.50	1.07	1.68	2.11	0.64	0.46		8180	8300	7060	98.5	85.2
1.47	26	S.	Light.	+0.63	-0.24		-1.16	-1.65		-2.00	-2.00	0.87	1.41	1.80	0.48	0.35		7370	7300	6200	101.0	85.0
1.48	27	S.E	Light.	+0.80	-1.07		-3.10	-4.43		-5.58	-5.70	1.87	3.36	3.90	1.33	1.15		0280	9950	9120	103.3	91.7
1.49	31	S.E		+0.81	-0.68		-1.75	-2.49		-2.96	-3.00	1.49	1.81	2.56	0.74	0.47		8540	8600	7225	99.3	84.0
1.50	31	S.E.		+0.75	-0.59		-1.75	-2.48		-3.00	-3.00	1.34	1.89	2.50	0.73	0.52		8630	8550	7030	101.0	82.3
1.52	Jun 2	W.S-W	Str.	+0.90	-0.48		-1.29	-1.77		-2.10	-2.10	1.38	1.29	2.19	0.48	0.33		7580	7100	5800	106.8	81.7
1.53	2	W.S-W.	Str.	+0.76	-0.32		-1.24	-1.81		-2.12	-2.06	1.08	1.49	2.00	0.57	0.31		7740	7850	6100	98.6	77.7
1.55	7	NW	Str.	+1.02	-0.13		-0.92	-1.61		-2.07	-2.00	1.15	1.48	1.94	0.69	0.46		8550	9200	7010	93.0	76.3
1.56	7	NW	Str.	+0.78	-0.11		-0.97	-1.58		-2.02	-2.00	0.89	1.47	1.75	0.61	0.44		8230	8500	6840	96.8	80.4
1.57	8	NW	Str.	+1.30	-0.57		-0.68	-1.38		-1.95	-2.00	1.87	0.81	1.98	0.70	0.57		9300	9500	7700	98.0	81.0
1.58	13			+0.92	-0.04		-0.93	-1.60	No Gage	-2.10	-2.07	0.96	1.56	1.85	0.67	0.50		8360	8950	7120	93.4	79.6
1.59	13			+0.87	0.00		-0.87	-1.55		-2.00	-2.00	0.87	1.55	1.74	0.68	0.45		8470	9300	7100	91.1	76.3
1.60	16			+1.06	-0.17		-1.26	-1.86		-2.35	-2.40	1.23	1.69	2.32	0.60	0.49		8250	8050	6260	102.3	77.8
1.62	Jul 9	S.W	Light.	+1.40	-0.76		-2.70	-4.07		-5.15	-5.20	2.16	3.31	4.10	1.37	1.08		10400	10650	10850	97.7	102.0
1.63	16	S.W.		+1.23	-1.00		-2.90	-4.24		-5.25	-5.30	2.33	3.24	4.13	1.34	1.01		9810	10250	10500	95.7	102.4
1.64	30			+1.11	-0.14		-0.99	-1.53		-1.95	-2.00	1.25	1.39	2.10	0.54	0.42		7800	8700	7000	89.7	80.4
1.65	Aug 20	S	Light	+0.95	-0.23		-1.03	-1.59		-1.90	-2.00	1.18	1.36	1.98	0.56	0.31		7430	8000	6460	92.9	80.7
1.66	Oct 1	S.W.	Light	+0.41	-1.75		-3.51	-4.74		-5.77	-5.95	2.16	2.99	3.92	1.23	1.03		8840	9000	9080	98.2	100.9
1.67	22			+0.45	-1.07		-2.31	-3.18		-3.85	-3.98	1.52	2.11	2.76	0.87	0.67		8200	8750	8570	93.8	98.0
1.68	Nov 12			+1.15	-0.77		-2.22	-3.19		-3.95	-4.00	1.92	2.42	3.37	0.87	0.76		8630	9500	8690	90.9	91.5
	1917																					
1.69	Jan 21			+0.55	-1.55		-2.59	-3.38		-3.95	-3.97		2.23		0.79	0.57		7640	8050	—		
1.70	Feb 18			+0.60	-1.14		-2.56	-3.36		-4.00	-4.00		2.22		0.80	0.64		7790	8150	7860	95.5	96.5
1.71	25	S	Light	+0.26	-1.26		-2.65	-3.41		-3.95	-3.98		2.15		0.76	0.54		7060	7800	7190	90.6	92.2

Fig. 7

time without requiring attention, and of printing, on a ribbon of paper, the actual elevations and the corresponding times.

The other gages have the advantage of giving a continuous record of the water level. The Haskell gage has ball bearings and is an extremely accurate instrument.

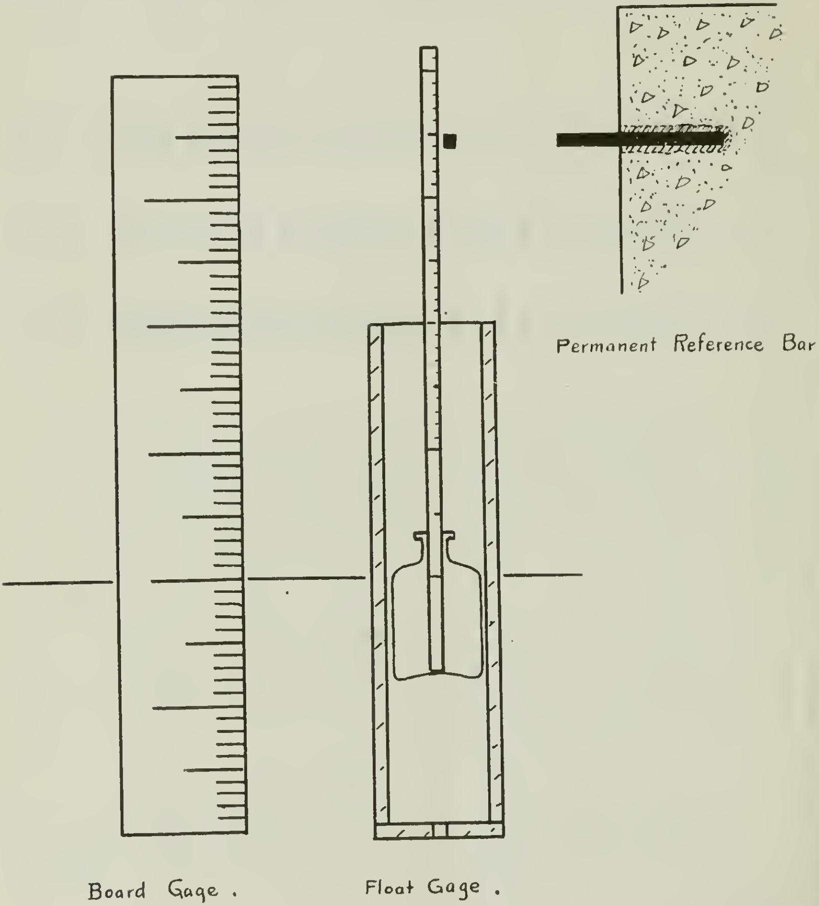


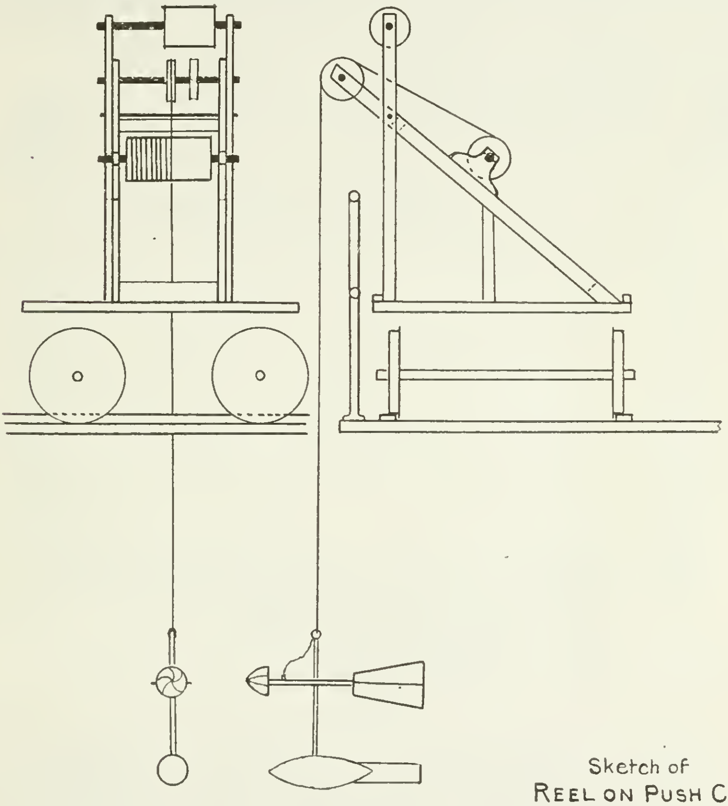
Fig. 8.

FLOAT GAGES.

This type of gage (Fig. 8) was used for referencing the self-registering gages. It consists of a graduated staff stuck in the neck of a bottle. This is floated in a stilling box directly under a permanent reference point, or index, so that the staff slides in a vertical position along one side of the index. The graduations are in feet and hundredths.

CURRENT METER OUTFIT.

a. *Current Meters (Screw Type) (Fig. 9).* Those used were the Haskell meter. Two were purchased from the manufacturers, Ritchie & Sons of Brookline, Mass., at the beginning of the work. These meters, No. 135 (with high and low pitch heads), and No. 147 (with low pitch head), were of recent design in which the head shaft forms part of the head, and the pin contact is at the side of the shaft. These are marked improvements and this type of meter has many advantages over any type of meter with which the writer is familiar.



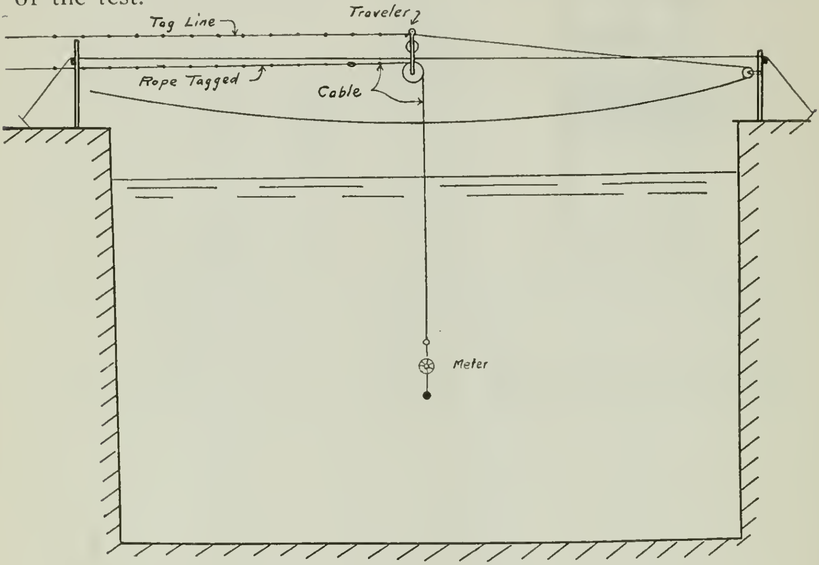
Sketch of
Reel on Push Car
and
Haskell Current Meter

Fig. 9

b. *Current Meters (Cut Type)*, manufactured by W. & L. E. Gurley of Troy, N. Y., are of two models, the large Price meters and the small Price meters.

Large Price Meters. The District had on hand and made available for this work, three Price current meters. Two of these, No.

219 and No. 225, were of the large size and not considered of sufficient accuracy for, nor adapted to the main flow measurements. These two meters and two others, No. 223 and No. 233, of the same model loaned to the District by Allis-Chalmers & Co. of Milwaukee, were used on the special 48-hour measurement of the flow in the Chicago River and the main channel September 5 to 7, 1914, when many meters were required for simultaneous observations. All of the meters used at this time were rated within a few days of the test.



Method of Handling Current Meter
On open Section
Coefficient Observations

Fig. 10

Small Price Current Meters. The other meter available, No. 518, was of the small model and better adapted to work in small streams than in the currents encountered in the main channel. It holds its rate much more constant than the large model, and was used on the index measurements from bridge sections on Chicago River where the currents are comparatively slower and where it is necessary to raise the meter from the water frequently and quickly on account of boats passing. A meter of this type, No. 359, was loaned to the District by the University of Michigan for use on the special flow measurements.

REEL.

At Lemont a reel was set up on a frame mounted on a push car. The meter was suspended on a cable from the reel as shown on Fig. 9. The car was run on a wooden track laid along the sidewalk of the Stevens Street bridge.

Cableway. At Lockport and other sections where there was no bridge to work from, a cable was stretched across the canal and the meter suspended as shown on Fig. 10.

Rods. Those used were designed by Assistant Engineer E. L. Cooley. These rods consist of various short lengths of 2-inch tubing threaded at the ends so that they can be coupled together to form longer rods, and weighted at one end to make them float in a vertical position.

ROD FLOAT OUTFIT.

The theory on which they are designed is, that they receive the force of the current over the entire submerged portion and should take that velocity which is the average to the depth of submergence.

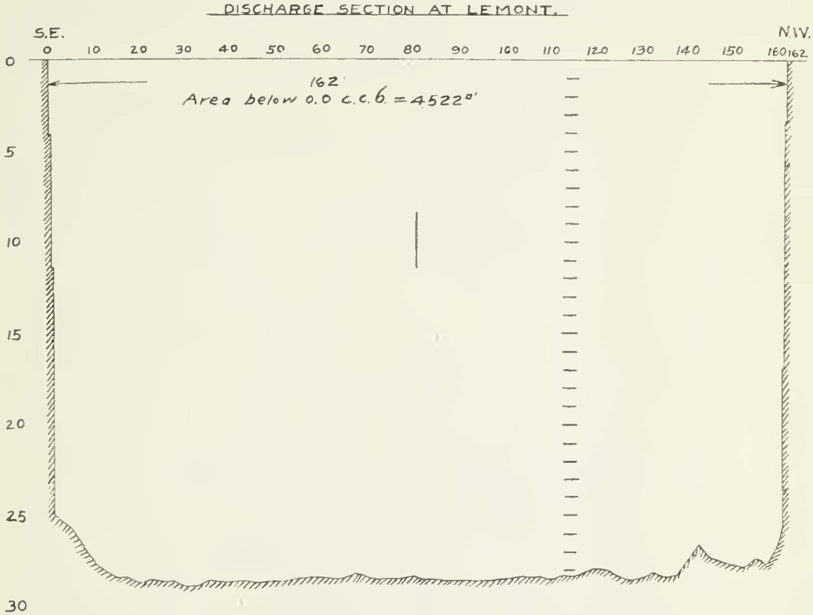
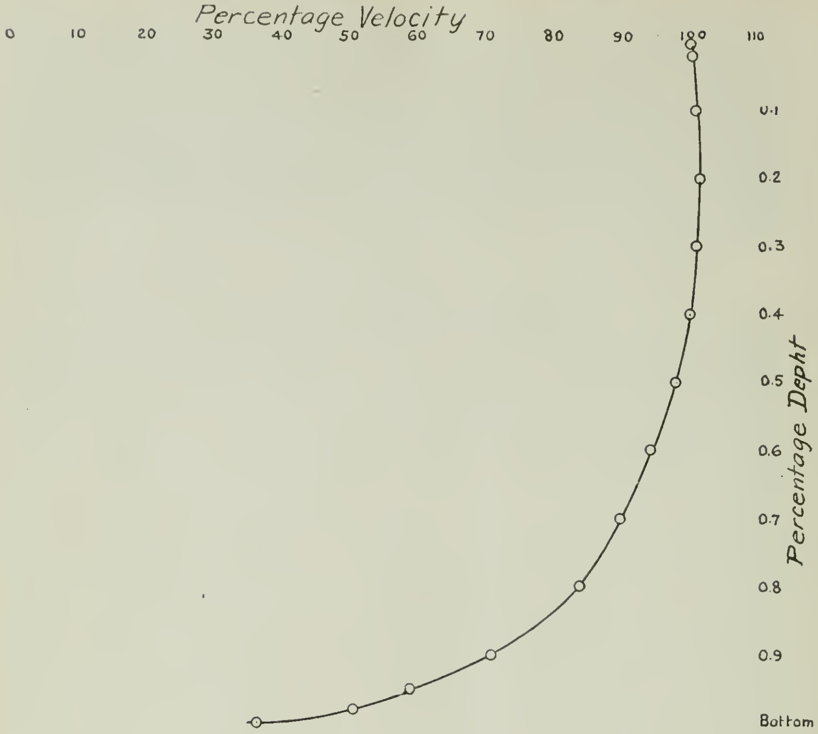


Fig. 11

GAGING SECTIONS.

Lemont. The main gaging station for the series of experiments was at Lemont and this section is along the upstream side of the Stephens Street bridge. The canal is on a tangent for two miles above and below this station. In sounding the section it was observed that it was free from sediment in the central portion and that there is a soft bottom for only a few feet at either end. The section was sounded at the beginning and at the end of the experiments and at intermediate dates. No material change occurred and the adopted area was 4,522 sq. ft. below C. C. D. This section is shown on Fig. 11.



THE SANITARY DISTRICT OF CHICAGO
MAIN CHANNEL
VERTICAL VELOCITY CURVE
LEMONT ILL.
MEAN OF 73 CURVES
OBS. 1914 – 1917
MEAN VELOCITY=.912+ V. 4 D.

Fig. 12

The U. S. Engineer Department used this section in making a series of flow measurements previous to 1914.

The U. S. Lake Survey used a section along the downstream side of the same bridge in making a series of flow measurements for two weeks in December, 1913.

For special flow measurements, gaging stations were established at Lockport, Willow Springs, Summit, Robey Street, Loomis Street, Washington Street and Dearborn Street.

AUXILIARY OBSERVATIONS.

Soundings. All of the current meter sections along the Chicago River and the main channel were sounded from a boat with a regular sounding outfit. A check on the depths was made by lowering the current meter to the bottom of the channel when making vertical curve measurements.

During the year 1914 and for some time previous there was in progress the widening of the narrow section of the main channel from Western Avenue to Summit. The stretch was sounded on completion of the work. To determine whether any of the material loosened by the dredging had been carried in suspension and deposited in the earth stretch below Summit or in the rock section below Willow Springs, typical soundings were taken on sections not over a thousand feet apart between Summit and Lemont. These soundings were plotted on the original cross section sheets. They showed that no material change had taken place in the rock section.

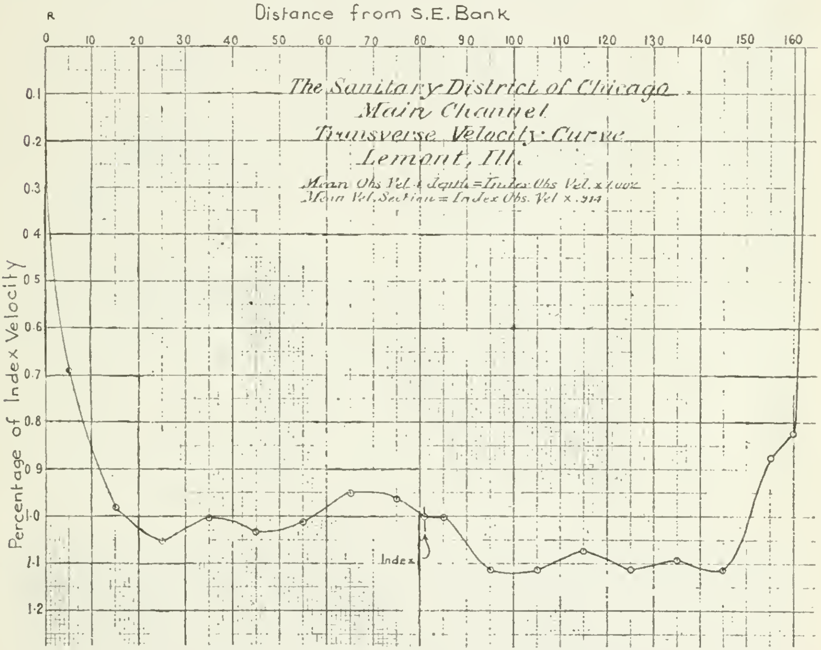


Fig. 13

It was found that some rock had been dropped into the channel at a loading platform about two miles above Lemont, but that the quantity was not sufficient to have a material effect on the slope-discharge relation.

Coefficient Work. Observations of the velocities in the vertical and transverse sections, with few exceptions, were made by the two meter method for the determination of coefficients to reduce the

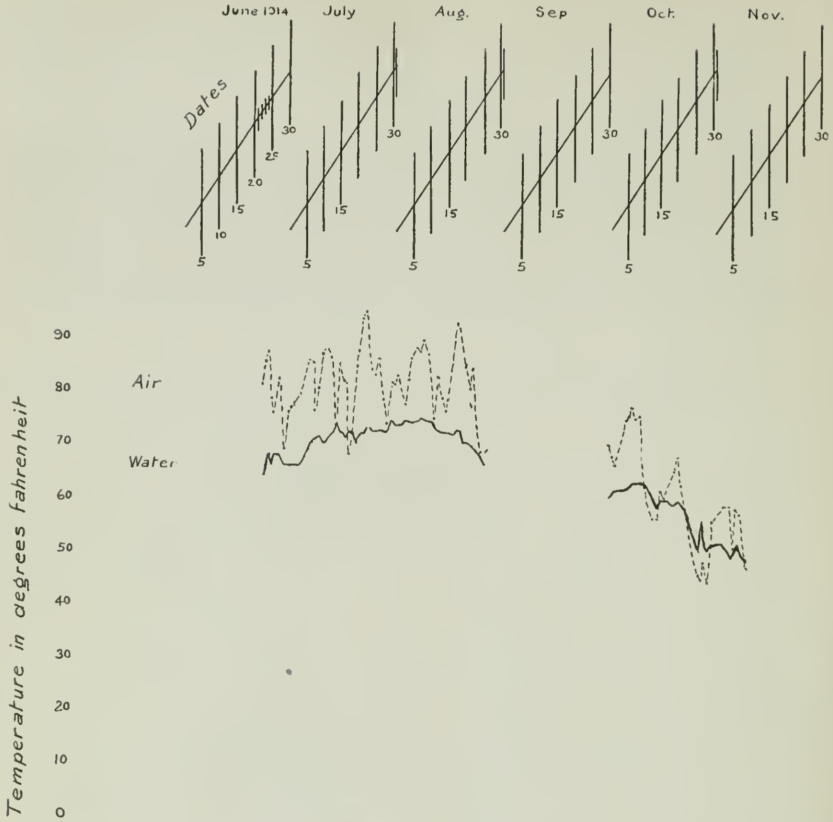


Fig. 14

observed velocity to the mean velocity of the section. When only one meter is used, more observations are required to give sufficient data to eliminate the effect of local fluctuations in the velocities.

The coefficients for the Lemont section were derived from 73 vertical curve and 49 transverse curve determinations. The final curves are shown on Figs. 12 and 13.

MISCELLANEOUS OBSERVATIONS.

Temperature. The temperature of the air and the water at Lemont as observed daily from July, 1914, to June, 1915, inclusive, while current meter measurements were in progress are shown on Fig. 14. The temperature of the water ranged from 75 to 32 degrees and of the air from 95 to 5 degrees Fahrenheit.

Certain observations were made to determine the effect of low temperatures on the discharge. A slight decrease in the quantities were noted, that is, the observations all fell on the same side of the general, or average, discharge curves, but the departures were

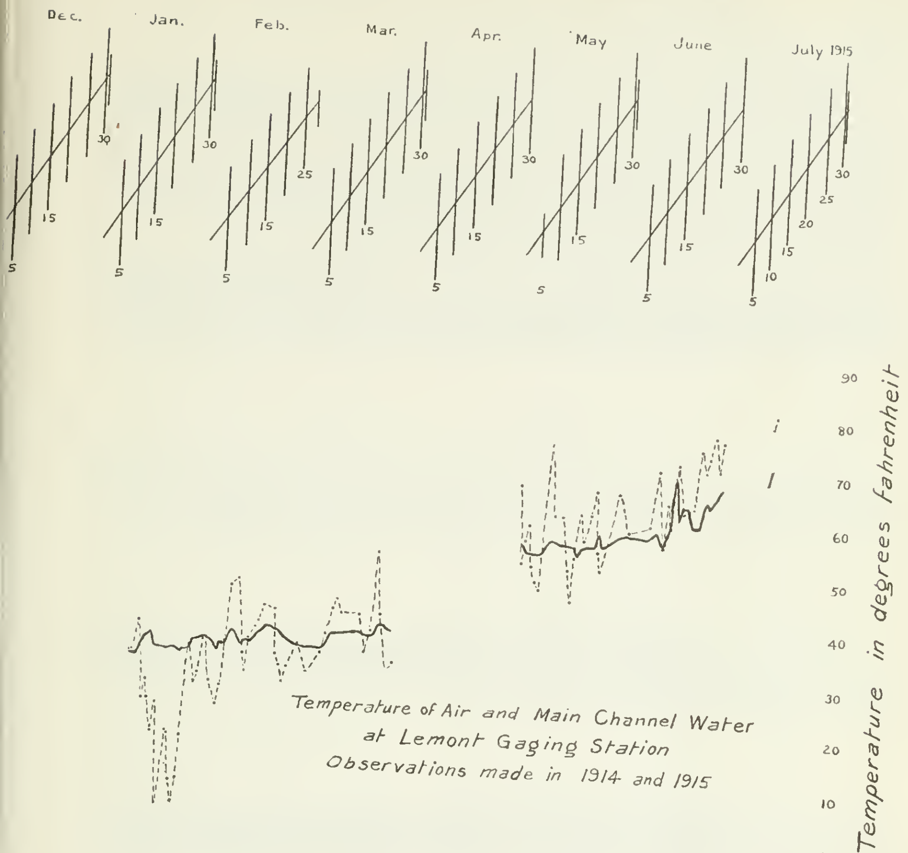


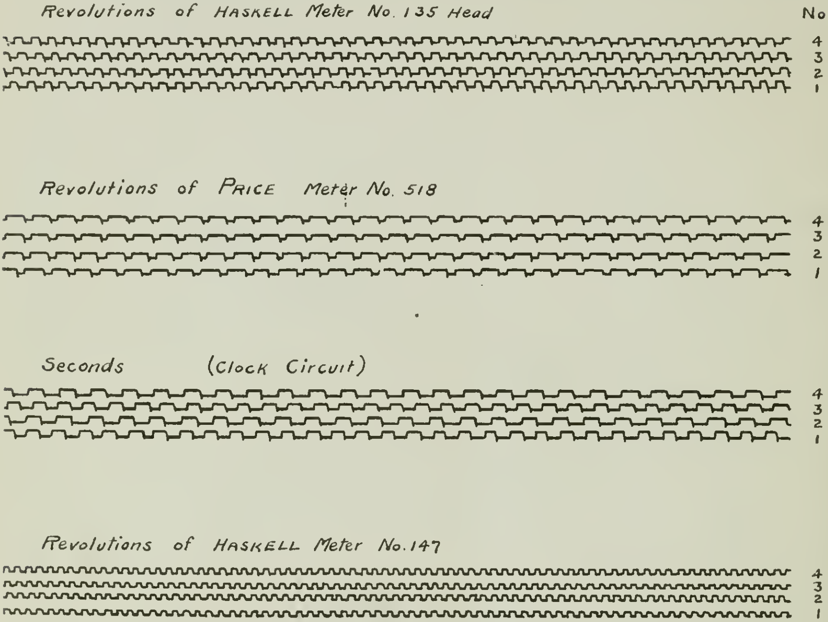
Fig. 14—Continued.

not greater than were obtained at other temperatures, indicating that the temperature effect while real is less than variations due to other causes.

Rating of Current Meters, Apparatus and Method. The naval tank of the University of Michigan, where this work was done, is well fitted for the purpose. It forms a canal of still water 20x600 feet and 6 feet deep. A rail is laid along each side on an overhanging projection, and on the track a car is mounted spanning the canal. The car is propelled by an electric power and can be run very steadily at any speed from ¼ to 10 feet per second. Three meters can be suspended at one time (spaced 4 feet apart) and rated simultaneously.

The meters are submerged to a depth of 3 to 4 feet below the water surface. The car is then run along the canal at the various speeds desired. A paper is mounted on a revolving 6-inch drum that is connected by a train of gears with the car wheels and callibrated so that the rate of travel to any point on the circumference is known in terms of the speed of the car.

Four fountain pens held in projecting clamps are mounted over the drum so that their points touch the paper, and when uncontrolled trace circumferential lines as the drum revolves. Each clamp is on the extension of the armature of an electro-magnet so that when the electric circuit is closed the pen is drawn in one direction parallel to the axis, and when the circuit is broken the opposing tension spring draws the pen in the opposite direction. At the instant that the pen is drawn in either direction, a short line is traced on the paper parallel to the axis, and while the circuit remains closed or open circumferential lines are drawn. The result is the jogged line shown on Fig. 15, which is the tracing of an actual record. One pen is in a clock circuit that is opened every second, and the others are in the separate meter circuits that are broken at each revolution of the meter head.



Tracing of Graphic Record
of
Rating in Naval Tank
at
Ann Arbor Mich

Fig. 15

Changes in Meter Rates. Table I contains ratings of the Haskell meters as used. In Table II the same rates are given as per-

TABLE I.

METER RATE COMPARISON—REVOLUTIONS CORRESPONDING TO VELOCITY.

RATINGS AT ANN ARBOR, MICH.

METER, HASKELL No. 135.

	IV	X	XXVIII	XXXI	XXXV	XL	LVII		LXI
	2-28-14	8-29-14	12-21-14	6-7-15	9-3-15	6-30-16	11-17-16	Mean	11-17-16
Vel. F.P.S.	Rev. R.P.S.	Rev. R.P.S.	Rev. R.P.S.	Rev. R.P.S.	Rev. R.P.S.	Rev. R.P.S.	Rev. R.P.S.	Rev. R.P.S.	Rev. R.P.S.
.10									
.20									
.30	.12								
.40	.23	.09	.13		.12				
.50	.33	.20	.24	.24	.23	.22	.41	.27	.37
.60	.445	.32	.355	.375	.34	.34	.51		
.70	.555	.43	.475	.50	.45	.46	.61		
.80	.66	.545	.59	.62	.57	.58	.71		
.90	.77	.66	.70	.73	.68	.70	.81		
1.00	.87	.775	.81	.84	.79	.81	.92	.83	.88
1.10	.97	.89	.925	.95	.90	.92	1.02		
1.20	1.08	1.00	1.04	1.07	1.01	1.03	1.12		
1.30	1.18	1.12	1.16	1.17	1.12	1.145	1.22		
1.40	1.28	1.24	1.28	1.28	1.23	1.25	1.32		
1.50	1.40	1.36	1.39	1.39	1.35	1.36	1.42	1.38	1.37
1.60	1.50	1.46	1.49	1.50	1.45	1.46	1.53		
1.70	1.61	1.57	1.59	1.60	1.56	1.57	1.63		
1.80	1.72	1.66	1.69	1.71	1.66	1.67	1.73		
1.90	1.82	1.77	1.79	1.82	1.77	1.77	1.83		
2.00	1.93	1.87	1.89	1.92	1.87	1.88	1.94	1.90	1.88
2.10	2.03	1.98	1.99	2.03	1.98	1.98	2.04		
2.20	2.13	2.07	2.09	2.14	2.08	2.08	2.14		
2.30	2.23	2.17	2.19	2.24	2.19	2.18	2.24		
2.40	2.34	2.27	2.29	2.355	2.30	2.28	2.34		
2.50	2.44	2.37	2.38	2.46	2.40	2.38	2.45	2.41	2.38
2.60	2.54	2.47	2.48	2.56	2.51	2.49	2.55		
2.70	2.65	2.57	2.58	2.655	2.61	2.59	2.65		
2.80	2.75	2.67	2.68	2.75	2.72	2.69	2.75		
2.90	2.85	2.76	2.77	2.85	2.82	2.80	2.85		
3.00	2.95	2.86	2.87	2.95	2.92	2.90	2.95	2.91	2.89
3.10	3.05	2.96	2.97	3.05	3.02	3.00	3.04		
3.20	3.16	3.06	3.07	3.14	3.12	3.10	3.14		
3.30	3.25	3.16	3.17	3.24	3.22	3.20	3.24		
3.40	3.34	3.255	3.27	3.34	3.32	3.30	3.34		
3.50	3.44	3.35	3.36	3.44	3.42	3.40	3.44	3.41	3.39
3.60	3.54	3.45	3.46	3.54	3.52	3.50	3.54		

TABLE II.

METER RATE COMPARISON—% REVOLUTIONS CORRESPONDING TO VELOCITY.

Rating at Ann Arbor, Mich.

COMPARED TO FIRST RATING—METER, HASKELL No. 135X.

	IV	X	XXVIII	XXXI	XXXV	XL	LVII		LXI
	2-28-14	8-29-14	12-21-14	6-7-15	9-3-15	6-30-16	11-17-16	Mean	11-17-16
Vel.	% Rev.	% Rev.	% Rev.	% Rev.	% Rev.	% Rev.	% Rev.	% Rev.	% Rev.
.50	100	61	73	73	70	67	124	82	112
1.00	100	89	93	97	91	93	106	95	101
1.50	100	97	99	99	96	97	101	99	98
2.00	100	97	98	100	97	98	101	98	97
2.50	100	97	98	101	98	98	100	99	98
3.00	100	97	97	100	99	98	100	99	98
3.50	100	97	98	100	99	99	100	99	99

Variation from First Rate.

METER HASKELL 135X.

	IV	X	XXVIII	XXXI	XXXV	XL	LVII		LXI
	2-28-14	8-29-14	12-21-14	6-7-15	9-3-15	6-30-16	11-17-16	Mean	
Vel.	Diff. %	Diff. %	Diff. %	Diff. %	Diff. %	Diff. %	Diff. %		Diff. %
.50	0	− 39	− 20	− 27	− 30	− 33	+ 24	− 18	+ 12
1.00	0	− 11	− 7	− 3	− 9	− 7	+ 6	− 5	+ 1
1.50	0	− 3	− 1	− 1	− 4	− 3	+ 1	− 1	− 2
2.00	0	− 3	− 2	− 0	− 3	− 2	+ 1	− 1	− 3
2.50	0	− 3	− 2	+ 1	− 2	− 2	0	− 1	− 2
3.00	0	− 3	− 3	0	− 1	− 2	0	− 1	− 2
3.50	0	3	− 2	0	− 1	− 1	0	− 1	− 1

Variation from Preceding Rate.

.50	0	− 39	+ 12	0	− 3	− 3	+ 57		− 12
1.00	0	− 11	+ 4	+ 4	− 6	+ 2	+ 13		− 5
1.50	0	− 3	+ 2	0	− 3	+ 1	+ 4		− 3
2.00	0	− 3	+ 1	+ 2	− 3	+ 1	+ 3		− 4
2.50	0	− 3	+ 1	+ 3	− 3	0	+ 2		− 2
3.00	0	− 3	0	+ 3	− 1	− 1	+ 2		− 2
3.50	0	− 3	+ 1	+ 2	− 1	0	+ 1		− 1

centages of the first rates of each meter. The variation of each rate from the first rate and from its preceding rate are tabulated. These variations for Haskell and Price meters are shown diagrammatically on Fig. 16.

Haskell meter No. 135, with low pitch head No. X, returned to its original rates for velocities of 2.00 to 3.60 sec-ft. For velocities of 1.00 sec-ft. and less the changes are irregular and large.

Haskell meter No. 147, at velocities 2.50 sec-ft. and over, held its rate constant for the greater part of three seasons and then lost 2% to 3%. For a velocity of 2 sec-ft. there was a slight gradual slowing up, and for the smaller velocities this gradual slowing up

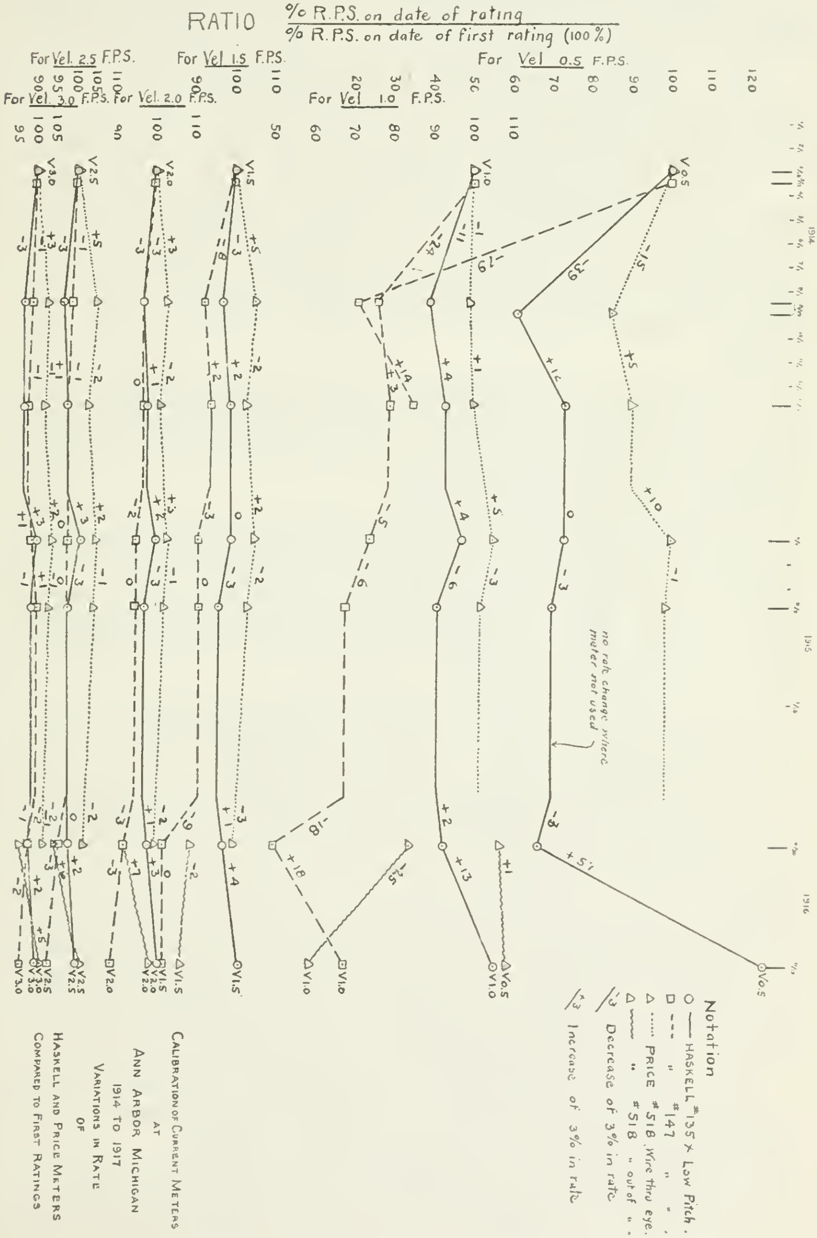


Fig. 16

also occurred, becoming excessive for velocities of 1.00 sec-ft. and under.

Haskell meter No. 135 with the high pitch head No. A, held its rate constant for velocities of 2 sec-ft. and over until the last rating, when there was a loss of from 6% to 13%. This meter head would not revolve at a lower velocity than 1.00 sec-ft.

Price meter No. 518 held its rate within 5% the first two seasons for velocities of 2 sec-ft. and over. For 1.00 sec-ft. the total change in rate was 7%. For 0.50 sec-ft., as with the other types of meters, the rates are very irregular.

The Haskell meters No. 135 and No. 147, with low pitch heads, were used steadily during the three seasons. The former was used as a standard meter for field rate comparisons and held its rate remarkably well considering the constant usage. The latter meter was equally constant in its rate in the higher velocities. An excessive rate change of meter No. 147 occurred between the first two ratings.

Price meter No. 518 held its rate nearly as well as the Haskell meters and was even the steadier on the very slow velocities. This meter was used only a few times on this work and then it was generally on the Chicago River sections where the water is not as badly polluted as at the Lemont section.

Haskell meter No. 135, with high pitch head, was seldom used, but was rated to compare with the meter heads which were in constant use. It held its rate constant for the higher velocities, as well as did the other Haskell meters, until the last rating, when it was noticed that the shaft was slightly bent, which may have accounted for the change. Fig. 17 shows the rating curves for the small Price meter and the Haskell meters.

The rates of the large Price meters were compared. It was found that they did not hold their rates constant and were very erratic except for velocities of 4 sec-ft. and above.

A Haskell meter might be struck by a partly submerged timber or cake of ice so as to slightly bend one or more of its blades without causing enough irregularity on the registering to be detected by the observer. In order to detect the occurrence of a sudden change in rate, the meters used on the flow measurements were daily run simultaneously side by side on the discharge section. After several runs were taken, the positions of the meters were exchanged to eliminate the effect of the constant difference in velocity of the meter stations. When the positions are not exchanged, the difference in station velocity according to the transverse curve has to be taken into account, which is not as satisfactory a method.

The ratio of the number of revolutions of one meter to the revolutions made by the other, or standard meter, should remain constant until the rate of one of the meters changes.

Another cause of rate change is the continual wear on the head shaft bearings. It is probable that this takes place gradually.

Changes in the stiffness of the contact spring affect the rate.

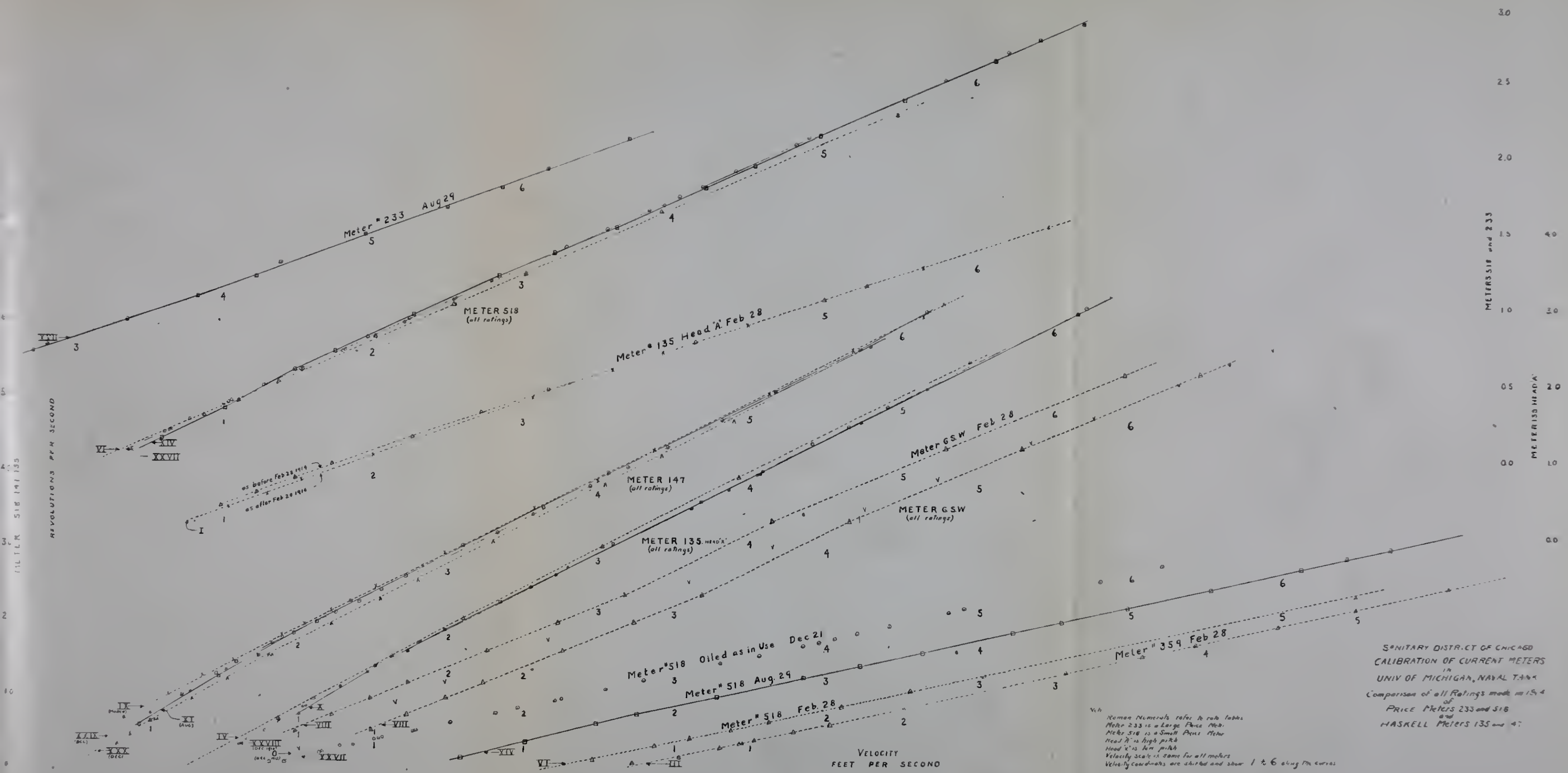


Fig. 17

SANITARY DISTRICT OF CHICAGO
CALIBRATION OF CURRENT METERS
in
UNIV OF MICHIGAN, NAVAL TANK
Comparison of all Ratings made in 1914
of
PRICE Meters 233 and 518
and
HASKELL Meters 135 and 147

Note
Roman Numerals refer to rate tables
Meter 233 is a Large Price Meter
Meter 518 is a Small Price Meter
Head "A" is high pitch
Head "X" is low pitch
Velocity scale is same for all meters
Velocity coordinates are shifted and show 1 to 6 along the curves

TABLE III.

METER RATE COMPARISON—REVOLUTIONS CORRESPONDING TO VELOCITY

RATING AT ANN ARBOR, MICH.

Meter Vel. F.P.S.	V Price 219 2-28-14 Rev. R.P.S.	XII Price 219 8-29-14 Rev. R.R.S.	XVIII Price 219 11-30-14 Rev. R.P.S.	XX Price 219 11-30-14 Rev. R.P.S.	XXI Price 219 11-30-14 Rev. R.P.S.	XXII Price 219 12-1-14 Rev. R.P.S.	VI Price 518 2-28-14 Rev. R.P.S.	XIV Price 518 8-29-14 Rev. R.P.S.	XXVII Price 518 12-21-14 Rev. R.P.S.
00									
.20		.007					.08	.025	.047
.40		.073					.163	.12	.14
.60	.147	.137	.01	.107	.117	.147	.247	.215	.23
.80	.207	.20	.09	.173	.173	.213	.33	.305	.32
1.00	.27	.263	.165	.24	.24	.277	.41	.40	.413
.10	.30	.293	.203	.277	.273	.31	.45	.45	.46
.20	.333	.325	.243	.31	.303	.343	.495	.50	.505
.30	.363	.357	.283	.343	.333	.377	.54	.55	.55
.40	.393	.387	.32	.377	.367	.41	.583	.60	.595
.50	.423	.417	.353	.41	.397	.443	.625	.65	.64
.60	.457	.447	.387	.443	.43	.473	.667	.70	.683
.70	.49	.477	.42	.477	.46	.507	.71	.74	.725
.80	.52	.507	.453	.51	.49	.54	.75	.783	.77
.90	.55	.537	.487	.543	.523	.57	.795	.825	.813
2.00	.58	.567	.52	.573	.553	.603	.837	.87	.855
.10	.613	.597	.555	.607	.583	.637	.88	.913	.90
.20	.64	.627	.59	.64	.617	.67	.92	.955	.943
.30	.67	.66	.623	.673	.647	.703	.963	1.00	.987
.40	.70	.69	.657	.707	.677	.737	1.005	1.045	1.03
.50	.733	.723	.69	.74	.71	.767	1.045	1.09	1.075
.60	.767	.76	.723	.773	.747	.80	1.087	1.13	1.12
.70	.803	.793	.757	.807	.783	.833	1.13	1.175	1.165
.80	.833	.827	.79	.84	.817	.863	1.175	1.217	1.213
.90	.863	.863	.823	.873	.853	.897	1.217	1.26	1.255
3.00	.893	.897	.86	.907	.89	.93	1.26	1.30	1.295
.20	.957	.963	.927	.927	.977	.96		1.39	1.383
.40	1.023	1.03	.993	1.043	1.033	1.063		1.47	1.47
.60	1.09	1.10	1.067	1.113	1.103	1.13		1.557	1.555
.80	1.15	1.167	1.14	1.187	1.175	1.20		1.64	1.643
4.00	1.213	1.233	1.21	1.257	1.247	1.267		1.725	1.73
.20	1.28	1.30	1.283	1.33	1.317	1.333		1.813	1.817
.40		1.37	1.353	1.40	1.39	1.40			
.60		1.44	1.425	1.47	1.46	1.47			
.80		1.507	1.497	1.543	1.53	1.537			
5.00		1.58	1.567	1.613	1.60	1.603			
.20				1.683	1.67	1.67			
.40				1.753	1.743				
.60				1.825	1.813				
.80				1.897	1.883				

Springs furnished by manufacturers vary slightly in stiffness and it could be expected that emergency springs made in the field would differ still more from those which they replace.

Alteration of the amount of oil on the bearings affects the rate. Changes in temperature may cause unequal expansion of the meter parts and affect the rate.

In the Price meters the rusting or blunting of the bearing or pivot point causes a decrease in the number of revolutions.

Special precautions were taken throughout the series of discharge observations to avoid, as far as possible, the changes in conditions which affect the rates.

Rate Experiments. Incidental to the Ann Arbor ratings and to the field comparisons, numerous experiments were made to determine the extent to which the different causes of rate change, enumerated, affect the rates.

The experiments on the large Price meters made November 30 to December 2, 1914, show the large variation in results that may obtain from the alteration of the conditions. The meter No. 21 as rated on November 30 had been merely given an ordinary cleaning, which consisted of wiping off the water from the blades and the bearing points. As rated on the following day, it had been given a very thorough cleaning, that is, taken apart and polished throughout. The resulting rating curves are a very considerable distance apart when plotted on the same set of co-ordinates. Thus for velocities of 1.00 to 3.00 sec-ft. the revolutions made after the cleaning were 10 to 7 more than before. As the

TABLE IV.

METER RATE COMPARISON—FRICTION

RATING AT ANN ARBOR, MICH.

METER, HASKELL No. 135X

Rating of June 30, 1916

Vel.	XL % Rev. (a)	XLVII % Rev. (b)	L % Rev. (c)	LII % Rev. (d)	LIII % Rev. (e)
.50					
1.00					
1.50	100	85			
2.00	100	87	79	98	104
2.50	100	88	82	99	101
3.00	100	89			100
3.50					

NOTATION

(a) Oil and run, as used to this date. (Standard for comparison.)
(b) Meter run with ⅝″ rope around body and stem.
(c) Meter run with 4″ knot at eye.
(d) Meter run with 2″ knot at eye.
(e) Meter run without oil.

total number of revolutions corresponding to these velocities is 30 to 80, it means that errors as large as 30% may result from the meters being rated in a cleaner condition than that in which they were when in commission. See ratings XVIII and XXII, Table III.

The difference in rate between using a blunt and a sharp or polished point are seen by comparing. See ratings XXI and XXII, Table III. For a velocity of 2.00 sec-ft. there was a difference of 5 revolutions in 55.

In 1916, at the June and December ratings, experiments were made to determine the effect of using various amounts of oil on the bearings, of bungling the exterior wires about the body and head of the meter and other similar manipulations sometimes practiced by inexperienced observers. Tables IV to IX inclusive give these ratings and the rates are compared as percentages in tables.

The condition of the meters in the rate experiments is given in Tables X and XI.

Referring to Table IV, a 2-inch knot near the head of a Price meter caused a decrease in speed of 2%.

Building up the diameters of the standards and the body similar to the excessive use of friction tape in holding the connection wires in place considerably decreased the rate.

In the flow measurements of the main channel a very small amount of oil was used to lubricate the bearings of the Haskell meters. It was expected that in this condition the rates would be more constant than if a considerable amount of oil were used. Referring to Tables V, VI and VII it is seen that for velocities of 2 sec-ft. and greater that there is very little difference whether there is no

TABLE V.

METER RATE COMPARISON—FRICTION

RATING AT ANN ARBOR, MICH.

METER, HASKELL No. 135X

Rating of November 17-18, 1916

Vel.	LVII % Rev. (a)	LVIII % Rev. (b)	LXI % Rev. (c)
.50	100	61	90
1.00	100	92	96
1.50	100	97	96
2.00	100	98	97
2.50	100	98	97
3.00	100	98	98
3.50	100	99	98

NOTATION

(a) Oiled and run, as used to this date. (Standard for comparison.)
(b) Run dry, no oil used.
(c) Meter thoroughly oiled.

TABLE VI.

METER RATE COMPARISON—FRICTION

Rating at Ann Arbor, Mich.
METER, HASKELL No. 147
Rating of June 30, 1916

Vel.	XLII % Rev. (a)	XLIV % Rev. (b)	XLV % Rev. (c)	XLVI % Rev. (d)	XLVIII % Rev. (e)
.50					
1.00					
1.50	100	95		84	
2.00	100	98	104	88	94
2.50	100	98	102	92	95
3.00	100	99	101		
3.50	100	99			

Notation

(a) Oiled and run as used to this date (Standard for comparison).

(b) No oil on bearings.

(c) Shaft well filled with oil making a great excess on bearings.

(d) Oiled as used. Extra heavy contact spring (practically as heavy as will permit head to revolve on slow velocities.)

(e) Oiled as used. Medium heavy contact spring. Not heavier than might be used in practice.

TABLE VII.

METER RATE COMPARISON—FRICTION

Rating at Ann Arbor, Mich.
METER, HASKELL No. 147
Rating of November 17-18, 1916

Vel.	LIV % Rev. (a)	LIX % Rev. (b)	LXII % Rev. (c)	LXVI % Rev. (d)
.50				
1.00	100	89	100	97
1.50	100	87	103	89
2.00	100	100	103	86
2.50	100	100	102	90
3.00	100	99	100	83
3.50	100	99	101	89

Notation

(a) Oiled and run, as used to this date. (Standard for comparison.)

(b) Meter run dry. No oil used.

(c) Meter thoroughly oiled.

(d) Meter run with rag on head.

TABLE VIII.

METER RATE COMPARISON—FRICTION
Rating at Ann Arbor, Mich.
METER, PRICE 518
Rating of June 30, 1916

Vel.	LI % Rev. (a)	XLIII % Rev. (h)	XLIX % Rev. (c)
.50			
1.00			
1.50	100	113	
2.00	100	109	105
2.50	100	107	105
3.00	100	106	104
3.50	100		

Notation

(a) As used before this date with wire around eye.
(b) As used after this date with wire through eye.
(c) Meter run with wire wrapped around body.

TABLE IX.

METER RATE COMPARISON—FRICTION
Rating at Ann Arbor, Mich.
METER, PRICE No. 518
Rating of November 17-18, 1916

Vel.	% Rev. (a)	% Rev. (b)
.50	100	129
1.00	100	107
1.50	100	99
2.00	100	100
2.50	100	101
3.50	100	101

Notation

(a) As used to this date. Old point wire out of eye. (Standard for comparison.)
(b) Meter run with old point, wire through eye.

oil on the bearings or run as used. Run dry, the retardation for 1.00 sec-ft. amounts to 10% and for 0.50 sec-ft. to 30%.

With an excess of oil, the speed may be increased as much at 4%, but apparently the effect soon wears off and is of short duration, and on November 17, 1916, Table V, the rate for velocities of 1.50 sec-ft. and greater when thoroughly oiled was the same as when run dry. It is probable that the water lubricates dry bear-

TABLE X.

CURRENT METER RATE CHANGES—AT VELOCITY 2.00 SEC. FT.

Ann Arbor Rating Curves

Meter No.	Vel. Sec.-Ft.	Rating No.	Date Rated	Condition	Rate Change
135	2.00	IV	Feb. 28/14	as used	3% above Aug., 1914
“	“	XXVIII	Dec. 14/14	“ “	1% “ “ “
“	“	XXXI	June 7/15	“ “	3% “ “ “
“	“	XXXV	Sep. 3/15	“ “	0% “ “ “
147	“	IX	Mar. 17/14	“ “	3% “ “ “
“	“	XXIX	Dec. 21/14	“ “	1% “ “ “
“	“	XXXII	Jun. 17/15	“ “	2% below “ “
“	“	XXXVI	Sep. 3/15	“ “	2% “ “ “
518	“	VI	Feb. 28/14	“ “	4% “ “ “
“	“	XXVII	Dec. 21/14	“ “	2% “ “ “
225	“	IIa	Feb. 28/14	“ “	17% “ “ “
“	“	XV	Aug. 29/14 (P.M.)	“ “	12% “ “ “
“	“	XIX	Nov. 30/14	Before cleaning	10% “ “ “
“	“	XXIII	Dec. 1/14	After “	10% “ “ “
“	“	XXIV	Dec. 2/14 (A.M.)	As used	2% above “ “
“	“	XXV	“ (P.M.)	“ “	6% below “ “
“	“	XXVI	“ (P.M.)	Reoiled	10% “ “ “
219	“	V	Feb. 28/14	As used	2% above “ “
“	“	XVIII	Nov. 30/14	Before cleaning	8% below “ “
“	“	XX	“	Before cleaning and point purposely blunted	1% above “ “
“	“	XXI	“	Cleaned and oiled point blunted	2% below “ “
“	“	XXII	Dec. 1/14	Cleaned and oiled, point polished	6% above “ “
G.S.W	“	VIII	Feb. 28/14	As used	13% below Dec. 1913

ings and in time brings them into practically the same condition as when excess oil has worked off.

An extra heavy contact pin caused a retardation of 10% (Table VI) and a medium heavy contact spring, comparatively only a slight degree heavier than the one ordinarily used, caused a retardation of 5%.

There is a small eye on the body of the Price meter provided for threading the circuit wire through in leading it to the contact spring. When a wire is used that is of too large a diameter to thread through, it might be run outside of the eye. The effect of doing this (Table IX) is not noticeable for velocities greater than 1.50 sec-ft. but is excessive on lower velocities and amounted to 29% on the rating on November 17, 1916.

The importance of having the meters rated as near as possible in the same condition as they are used is readily seen, and it

TABLE XI.

COMPARISON OF METER RATES—CONDITION OF METERS

Meter	Rate Table	Date	Condition of Meter
219	V	2-28-14	Meter as used before this date.
	XII	8-29-14	Meter as used before this date.
	XIIa	8-29-14	Meter as used.
	XVIII	11-30-14	Meter rated before cleaning.
	XX	11-30-14	Meter rated before cleaning. Point purposely blunted.
	XXI	11-30-14	Meter cleaned and oiled. Point purposely blunted.
	XXII	12-1-14	Meter cleaned and oiled. Polished point.
225	II	2-28-14	Meter as used before this date.
	IIa	2-28-14	Meter as used.
	XIII	8-29-14 A. M.	Meter as used before this date.
	XV	8-29-14 P. M.	Meter as used before this date.
	XIX	11-30-14	Meter rated before cleaning.
	XXIII	12-1-14	After cleaning.
	XXIV	12-2-14 A. M.	Meter as used before this date.
	XXV	12-2-14 P. M.	Meter as used before this date.
	XXVI	12-2-14	Meter reoiled.
147	XXX	12-21-14	Meter dry (all oil removed).
All other ratings			Meters as used.

is advisable to have the ratings done or supervised by someone familiar with these conditions or preferably by one of the observers.

VELOCITY FLUCTUATIONS.

Experiments. The fluctuations that take place from the surface to the bottom of the stream in the measurement of the vertical curves is illustrated in Fig. 18. Similar fluctuations occur across the stream and are encountered in the measurement of the transverse curves, Fig. 19.

Four current meters were run simultaneously in 1914 on the Lemont section. On Fig. 20 are plotted the runs of September 30, October 1, 2 and 13. The effect of meter rates as well as the current fluctuations enter into the comparison of the results. For this reason the observations have been first plotted with the rate of the rating preceding the observations and then with the rate of the rating following the observations.

It appears that the fluctuations are not always similar throughout the section, being of greater intensity at one station than another. In general, however, the current increases or decreases simultaneously at all stations.

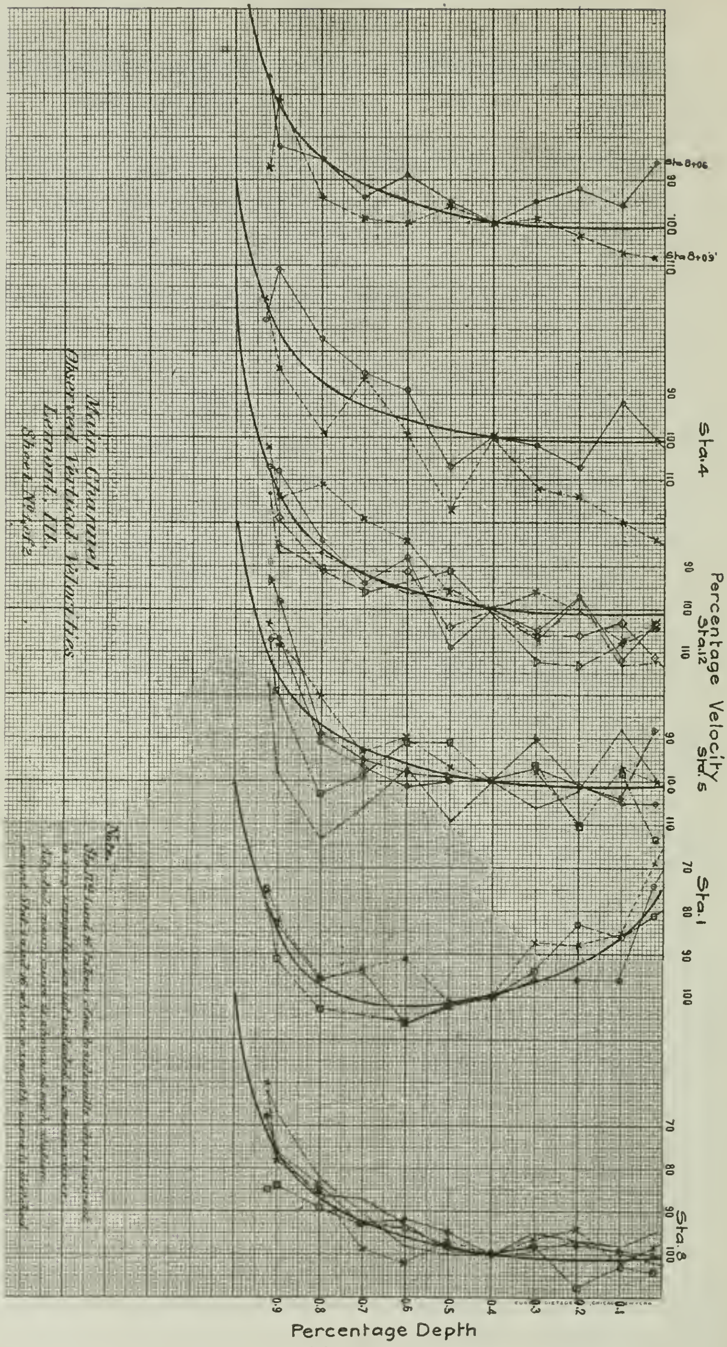

Main Channel
Observed Vertical Velocities
Lemont, Ill.
Sheet No. 1 of 2
Note.
Percentage Velocity
Sta. 8+06
Sta. 8+03'
Sta. 4
Sta. 12
Sta. 5
Sta. 1
Sta. 8
70
80
90
100
110
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
Percentage Depth

Fig. 18

METHODS OF ELIMINATION OF FLUCTUATION EFFECT.

In practically all of the discharge measurements, two meters were run simultaneously. Averaging a large number of runs at two stations thus occupied gave the same difference in velocity between these stations as was obtained in the determination of the transverse curve.

The party of the U. S. Lake Survey in December, 1913, in their flow measurements on this section obtained practically the same vertical curve as was obtained in these experiments and they used the same two meter method.

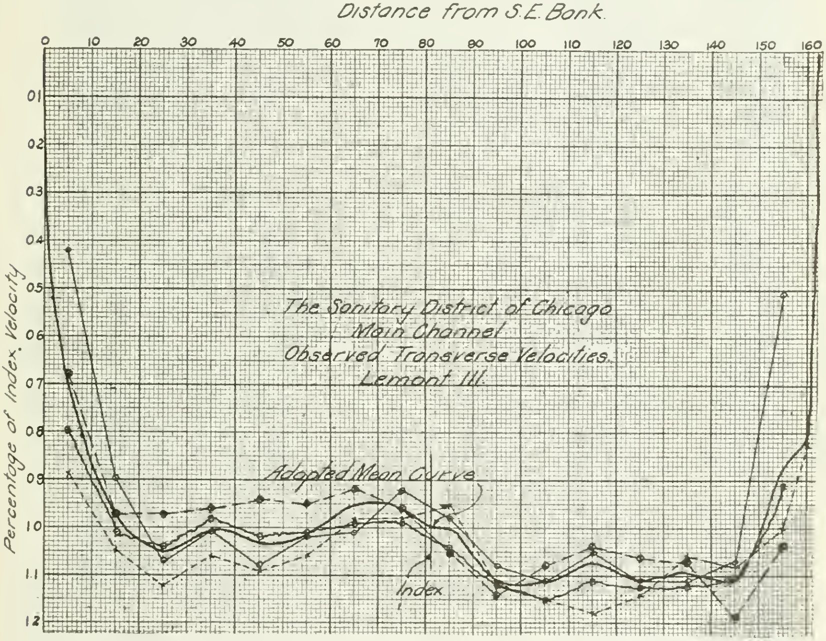


Fig. 19

In the two meter method one of these meters is operated at a fixed point, called the index, while the other is run successively at the required points of the vertical and transverse curves. The curve velocities are corrected by coefficients which are the ratio of the simultaneous index velocity to the average or to any index velocity.

Where only one meter is used the effect of fluctuations is only obtained by the averaging of a much larger number of observations.

SCREW VERSUS CUP TYPE METERS.

Cup Type. The results of the Ann Arbor ratings indicate that the large Price meters are extremely unreliable and not in the same class with the others compared.

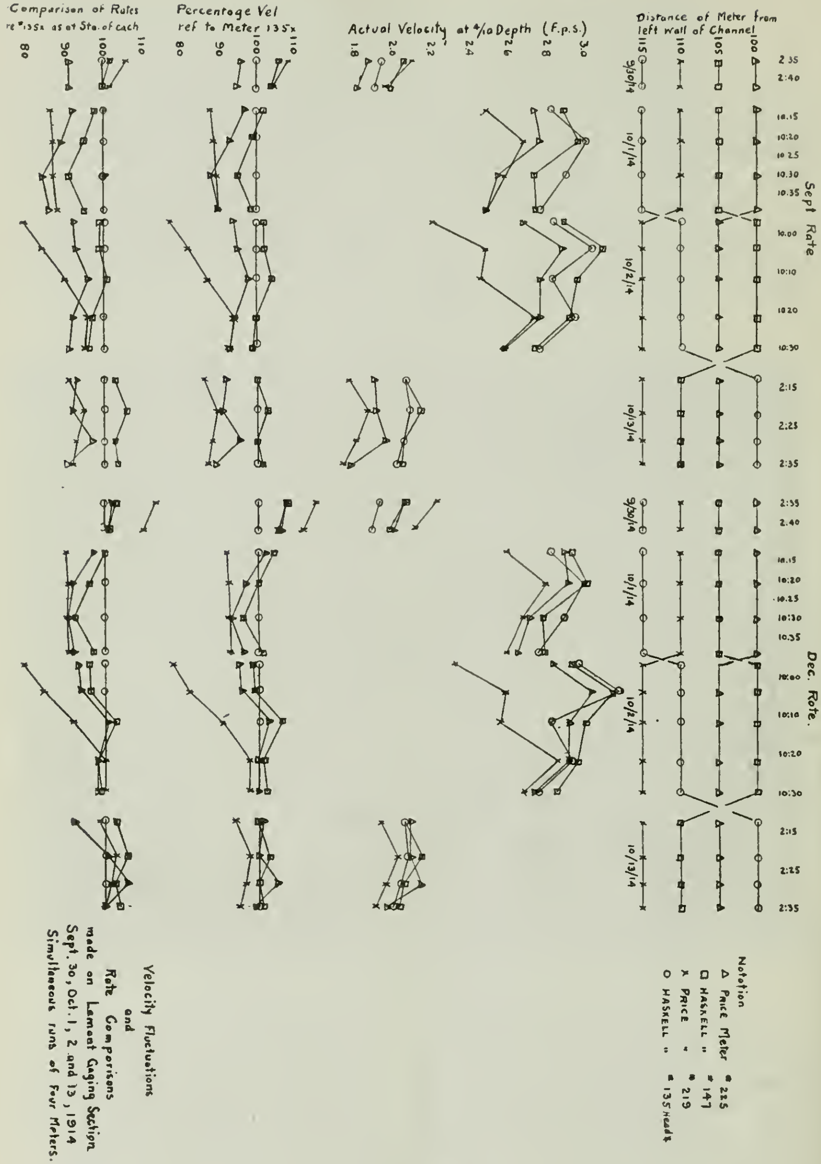


Fig. 20

The small Price meters held their rates better than the large Price meters, and in this respect, for the slow velocities, compare favorably with the Haskell meters. The small Price meters that were tested appear to be better adapted to use in smaller streams than elsewhere, for they are light and easily handled, and with

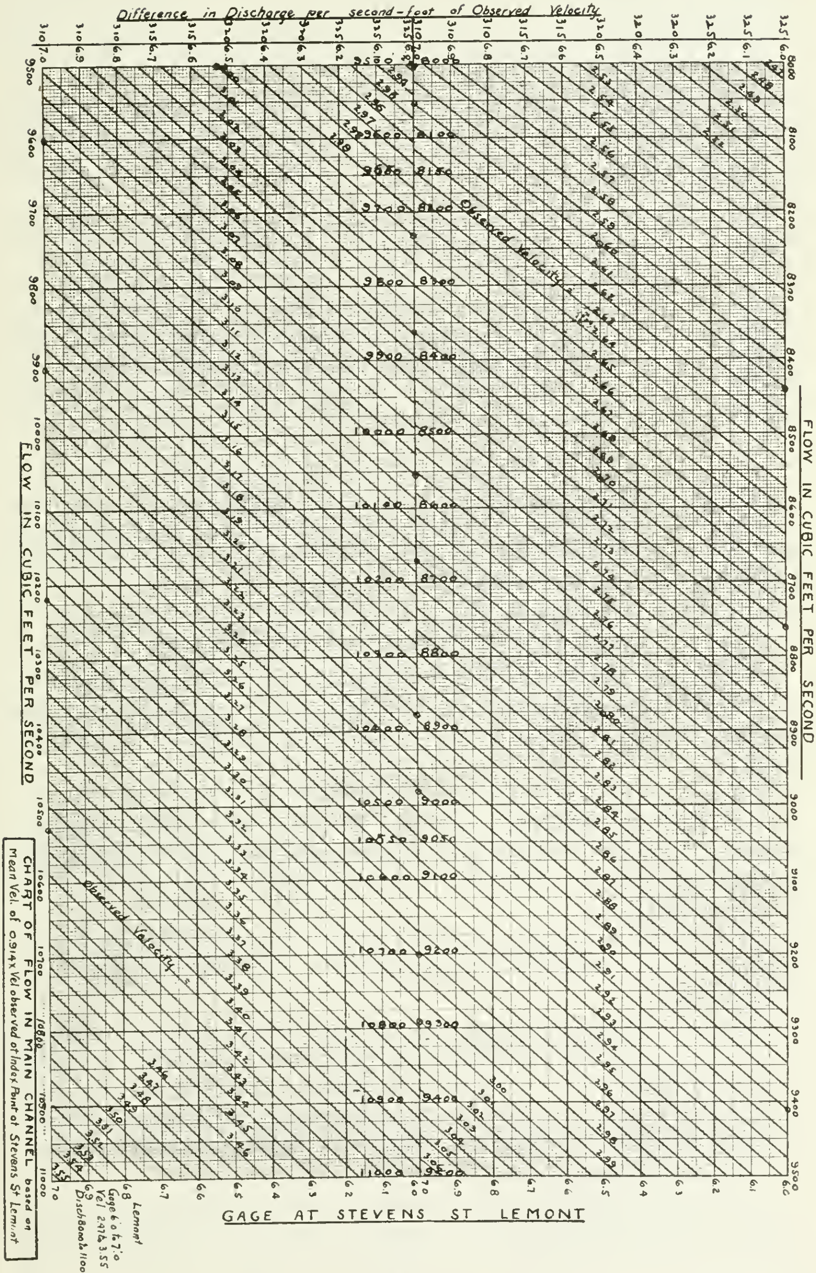

Difference in Discharge per second-foot of Observed Velocity
FLOW IN CUBIC FEET PER SECOND
FLOW IN CUBIC FEET PER SECOND
GAGE AT STEVENS ST LEMONT
CHART OF FLOW IN MAIN CHANNEL based on
Mean Vel. of 0.914 x Vel observed at Index Point at Stevens St Lemont
Observed Velocity
Observed Velocity
Lemont
Gage 6 to 7.0
Vel 2.47 to 3.55
Disch 8000 to 11000
9500
9600
9700
9800
9900
10000
10100
10200
10300
10400
10500
10600
10700
10800
10900
11000
8000
8100
8200
8300
8400
8500
8600
8700
8800
8900
9000
9100
9200
9300
9400
9500
7.0
6.9
6.8
6.7
6.6
6.5
6.4
6.3
6.2
6.1
6.0

Fig. 21

their low standard and small weight can be run close to the bed of the river or stream. This is also possible with the smaller (Type D) Haskell meter of the screw type, but it is not possible with the Type B Haskell meter used on this work.

Screw Type. The Haskell meters used here appear to be a more accurate and reliable instrument than the Cup Types, especially the large Price, for several reasons, among which are the following:

(a) The ball bearing swivel part of the standard permits the meter to swing freely and thus head directly into the current.

(b) The long shaft attached to the head and extending into the meter body increases the bearing surface so that the friction coefficient is less liable to change than where a slight point is depended upon, for the latter quickly and easily becomes blunted and rusted as it is generally treated. The effect of the blunting of the point is seen in the rate experiments.

TIME INTERVAL OF STAGE OSCILLATIONS.

The oscillations in the stage at any considerable distance from their starting point are not generally well defined; however, there are numerous instances from which to determine it approximately, and from these are observed the following:

Interval from Power House to Willow Springs, 1 hour.
Interval from Power House to Lemont, ½ hour.
Interval from Power House to Western Avenue, 1½ to 3 hours.

Above Western Avenue the changes are gradual and not well defined. They are affected by the wind and variations in the lake stage.

DISCHARGE-STAGE RELATION.

A discharge diagram, Fig. 21, derived from the preliminary soundings, coefficients and other data, was used in obtaining the discharge at Lemont for the observed velocities and elevations of the water surface.

For the final values of the discharges further coefficients were applied to the results thus obtained which took into account all revised data.

In the original computations the rate of the meter determined at the rating nearest the date of observation was used. A coefficient was applied in the final computations to reduce the rate used to the interpolated rate between the ratings preceding and following the date of observation. This is a refinement not generally applied but deemed expedient in this case.

The revised discharges with the corresponding elevations of the water surface and fall are given in Figs. 5 to 7 and plotted in reference to the elevations at Lemont and Willow Springs on Fig. 22.

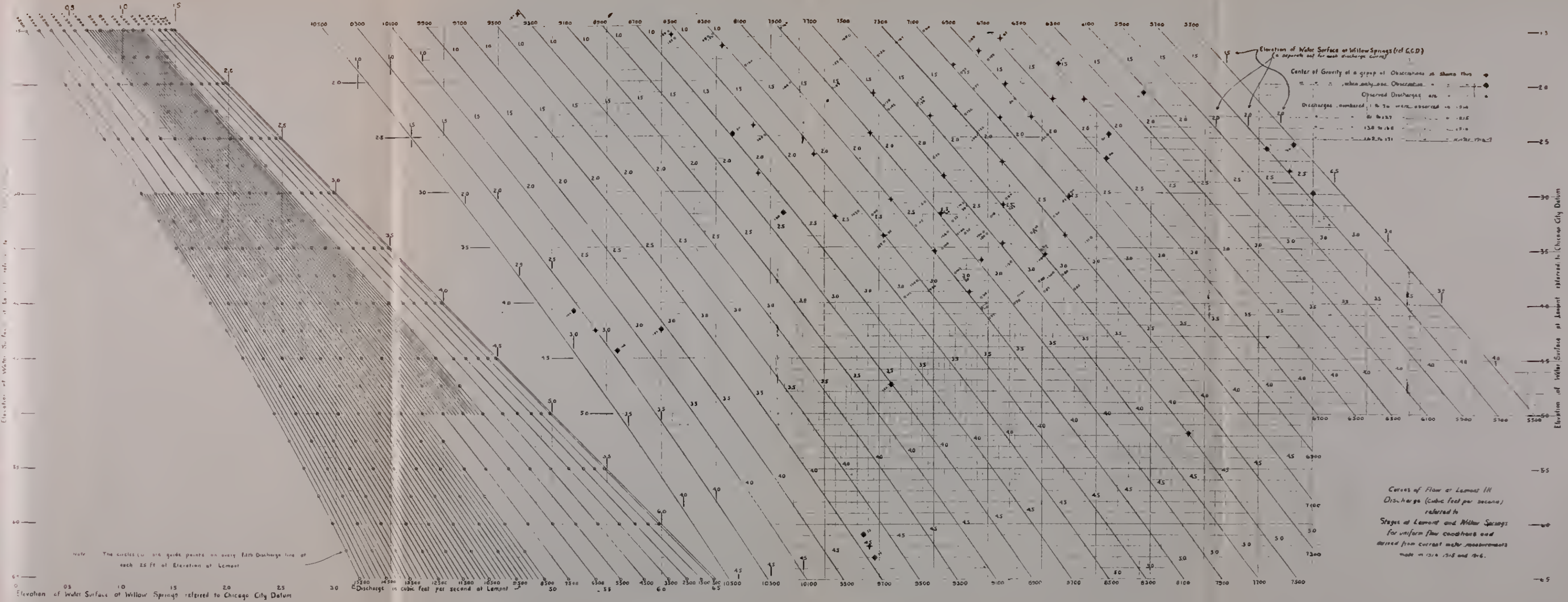

Elevation of Water Surface at Willow Springs (ref C.C.D.)
(a separate set for each discharge curve)
Center of Gravity of a group of Observations is shown thus ◆
" " " , when only one Observation " ◆
Observed Discharges are •
Discharges numbered 1 to 70 were observed in 1914
" " 71 to 137 " " " 1915
" " 138 to 168 " " " 1916
" " 169 to 171 " " " winter 1916-17
Curves of Flow at Lemont Ill
Discharge (cubic feet per second)
referred to
Stages at Lemont and Willow Springs
for uniform flow conditions and
derived from current meter measurements
made in 1914 1915 and 1916.
Note The circles (o) are guide points on every fifth Discharge line at each 25 ft of Elevation at Lemont
Elevation of Water Surface at Willow Springs referred to Chicago City Datum
Discharge in cubic feet per second at Lemont
Elevation of Water Surface at Lemont referred to Chicago City Datum
0 05 10 15 20 25 30
15300 14500 13500 12500 11500 10500 9500 8500 7500 6500 5500 4500 3500 2500 1500 10500 10300 10100 9900 9700 9500 9300 9100 8900 8700 8500 8300 8100 7900 7700 7500
10500 10300 10100 9900 9700 9500 9300 9100 8900 8700 8500 8300 8100 7900 7700 7500 7300 7100 6900 6700 6500 6300 6100 5900 5700 5500
6700 6500 6300 6100 5900 5700 5500 6900 7100 7300
1.5 2.0 2.5 3.0 3.5 4.0 4.5 5.0 5.5 6.0 6.5

Fig. 22

The method used in deriving the discharge-stage relation is as follows:

The observed discharges were grouped according to volume every 200 sec-ft. Each group was then considered separately. See Table 12.

TABLE XII.

CENTERS OF GRAVITY OF TRIAL DISCHARGE CURVES

Obs. No.	Group	Discharge C.F.S.	Elevation of Water Surf E_1	E_2	Centers of Gravity Upper Set of Obs. E_1	E_2	All Observations E_1	E_2	Lower Set of Obs. E_1	E_2
76	5500	5435	2.55	2.12			2.55	2.12		
7	5700	5760	2.59	2.17	2.59	2.17	2.79	2.38	2.99	2.60
11		5750	2.99	2.60						
131	6100	6180	2.09	1.63			2.09	1.63		
47	6500	6535	1.83	1.45	1.83	1.45	2.15	1.68	2.47	1.92
91		6455	2.47	1.92						
65	6700	6750	1.60	1.21	1.60	1.21	2.14	1.70	2.69	2.19
86		6610	2.69	2.19						
49	6900	6900	1.63	1.23	1.71	1.31				
129		6950	1.80	1.40			2.02	1.56		
56		6985	2.15	1.65					2.31	1.80
121		6955	2.48	1.95						
60	7100	7125	1.54	1.11	1.84	1.38				
62		7095	1.92	1.46						
55		7000	2.06	1.57			2.32	1.81		
94		7130	3.02	2.45					3.03	2.44
85		7090	3.05	2.44						
147	7300	7365	1.65	1.17	2.22	1.70				
132		7380	2.29	1.80						
122		7335	2.46	1.91			2.72	2.13		
130		7390	2.48	1.91						
20		7280	3.22	2.61					3.39	2.71
23		7425	3.37	2.70						
108		7410	3.58	2.81						
152	7500	7580	1.77	1.29	2.31	1.77				
137		7440	2.19	1.66						
139		7440	2.22	1.67						
24		7460	3.06	2.47						

TABLE XII.—Continued

Obs. No.	Group	Discharge C.F.S.	Elevation of Water Surf. E_1	Elevation of Water Surf. E_2	Upper Set of Obs. E_1	Upper Set of Obs. E_2	Centers of Gravity All Observations E_1	Centers of Gravity All Observations E_2	Lower Set of Obs. E_1	Lower Set of Obs. E_2
43	7500	7560	3.15	2.50			3.10	2.44	3.56	2.83
19		7430	3.34	2.72						
92		7430	3.52	2.79						
111		7430	3.53	2.80						
120		7515	3.73	2.90						
84		7550	3.75	2.99						
83		7500	3.90	3.10						
1	7500	7495	5.18	4.15			5.18	4.15		
165	7700	7430	1.59	1.03	2.11	1.55				
153		7745	1.81	1.24						
138		7680	2.22	1.66						
142		7740	2.26	1.70			2.85	2.20		
32		7655	2.69	2.11						
110		7605	3.10	2.37					3.46	2.73
39		7770	3.12	2.41						
18		7600	3.21	2.63						
113		7780	3.63	2.81						
88		7600	3.81	3.07						
87		7605	3.90	3.12						
164	7900	7805	1.53	0.99	2.47	1.82				
143		7990	2.07	1.47						
116		7840	3.09	2.32			3.19	2.47		
40		7815	3.18	2.50						
33		7925	3.26	2.58					3.61	2.84
126		7905	3.36	2.53						
106		7840	3.38	2.62						
35		7860	3.37	2.69						
34		8095	3.95	3.14						
101		7915	3.94	3.18						
98		7820	4.00	3.14						
144	8100	8180	2.02	1.38	3.07	2.31				
105		8140	3.31	2.54						
127		8210	3.45	2.55			3.53	2.71		
100		8080	3.51	2.78						
107		8080	3.73	2.90					3.90	3.03
99		8105	3.78	2.98						
96		8215	3.88	2.97						
118		8005	4.04	3.14						
115		8060	4.06	3.14						
97	8100	8095	4.14	3.21						
117		8170	4.37	3.34						

TABLE XII.—Continued

Obs. No.	Group	Discharge C.F.S.	Elevation of Water Surf. E$_1$	E$_2$	Centers of Gravity Upper Set of Obs. E$_1$	E$_2$	All Observations E$_1$	E$_2$	Lower Set of Obs. E$_1$	E$_2$
156	8300	8230	1.58	0.97	1.68	1.05				
158		8360	1.60	0.93						
160		8245	1.86	1.26			2.66	1.90		
167		8200	3.18	2.31					3.39	2.54
44		8335	3.21	2.44						
95		8260	3.39	2.57						
124		8335	3.80	2.85						
159	8500	8470	1.55	0.87	1.58	0 88				
155		8545	1.61	0.92			2.40	1.64		
149		8545	2.49	1.75					3.22	2.39
102		8500	3.95	3.04						
150	8700	8630	2.48	1.75	2.48	1.75	2.83	1.98		
168		8630	3.19	2.22					3.19	2.22
166	8900	8845	4.74	3.51			4.74	3.51		
157	9300	9300	1.38	0.68			1.38	0.68		
72	9700	9615	6.09	4.46	6.09	4.46	6.19	4.51		
74		9675	6.30	4.56					6.30	4.56
163	9900	9810	4.24	2.90			4.24	2.90		
162	10300	10395	4.07	2.70	4.07	2.70	4.25	2.90		
148		10280	4.43	3.10					4.43	3.10
		Winter Discharges (Temperature of Water 32 deg. F.)								
171	7100	7060	3.41	2.65						
169	7700	7640	3.38	2.59						
170		7790	3.36	2.56						

The observations were plotted with reference to the elevations of the water surface at Willow Springs and Lemont and preliminary discharge curves were computed and drawn through them. Between the Lemont stages of —1.50 and —4.00, it was seen by inspection that straight lines would fit the observations fairly well and they were computed by the center of gravity method. The c. g. points are given in Table XII and plotted on Fig. 22.

For each half foot of elevation at Lemont, the hydraulic radius and velocity at Lemont and Willow Springs and the slope between them were deduced from the preliminary discharge curves.

To investigate the relation of the slope and velocity log S was plotted against log V. It was observed that the lines joining the points on each curve were approximately straight and parallel. The lines were then taken as exactly straight and parallel to the best determined line, the 7,900 sec-ft. curve, which made an angle with the log S axis whose tangent is .197. The equation of this series of lines is

$$\log V_M = (\log m) + .197 \log S$$

in which log m, the intercept on the log V_M axis, is a variable.

To bring the hydraulic radius into the equation, its effect was considered for a constant slope of .00001585 the log of which is 5.2000. This slope represents a fall between Willow Springs and Lemont of .617 feet.

For each half foot of Lemont elevation, with this slope, the corresponding elevations at Willow Springs were deduced. In Table XIII are these elevations with their corresponding areas and hydraulic radii, also the mean areas and mean hydraulic radii. On Fig. 23 are the area and hydraulic radii curves.

TABLE XIII.

HYDRAULIC ELEMENTS.

E_1	E_2	E_M	A_1	A_2	A_M	R_1	R_2	R_M
1.00	0.383	0.6915	4358	42315	42945	20.56	19.024	19.892
1.50	0.883	1.1915	4277	4150	42135	20.27	18.7405	19.505
2.00	1.383	1.6915	4196	40685	4143	19.98	18.457	19.2185
2.50	1.883	2.1915	4115	3987	4051	19.685	18.168	18.926
3.00	2.383	2.6915	4034	39055	3970	19.39	17.879	18.6345
3.50	2.883	3.1915	3953	3824	38855	19.115	17.585	18.350
4.00	3.383	3.6915	3872	37425	3807	18.84	17.291	18.0655
4.50	3.883	4.1915	37915	3661	3726	18.56	16.9915	17.775
5.00	4.383	4.6915	3711	35795	36455	18.28	16.692	17.486
5.50	4.883	5.1915	36305	34985	35645	17.97	16.3875	17.178
6.00	5.383	5.6915	3550	34165	34835	17.66	16.083	16.872
6.50	5.883	6.1915	34695	3335	34025	17.345	15.7725	16.559

The location of the series of curves represented by the above equation was then fixed by passing them through two of the mean groups of discharges. The problem then was to determine how close all of the other observations would satisfy the equation, or formula, thus derived.

The points that were taken as established (called A and B) were the mean of the three lowest discharges, No. 76, No. 7 and No. 11, and the mean of the three highest discharges No. 163, No. 16 and No. 148, Table XII.

Parallel lines making an angle with log S axis whose tangent is .197 were passed through the points A and B giving log m for each. Their intersection with the log V_M ordinate at log $S = 5.2$ is the log V_M for the constant slope .00001585.

The discharges divided by those velocities gave the mean areas, and from the relation of A_M and R_{MK} (Fig. 24), the corresponding values of R_{MK} were obtained. .

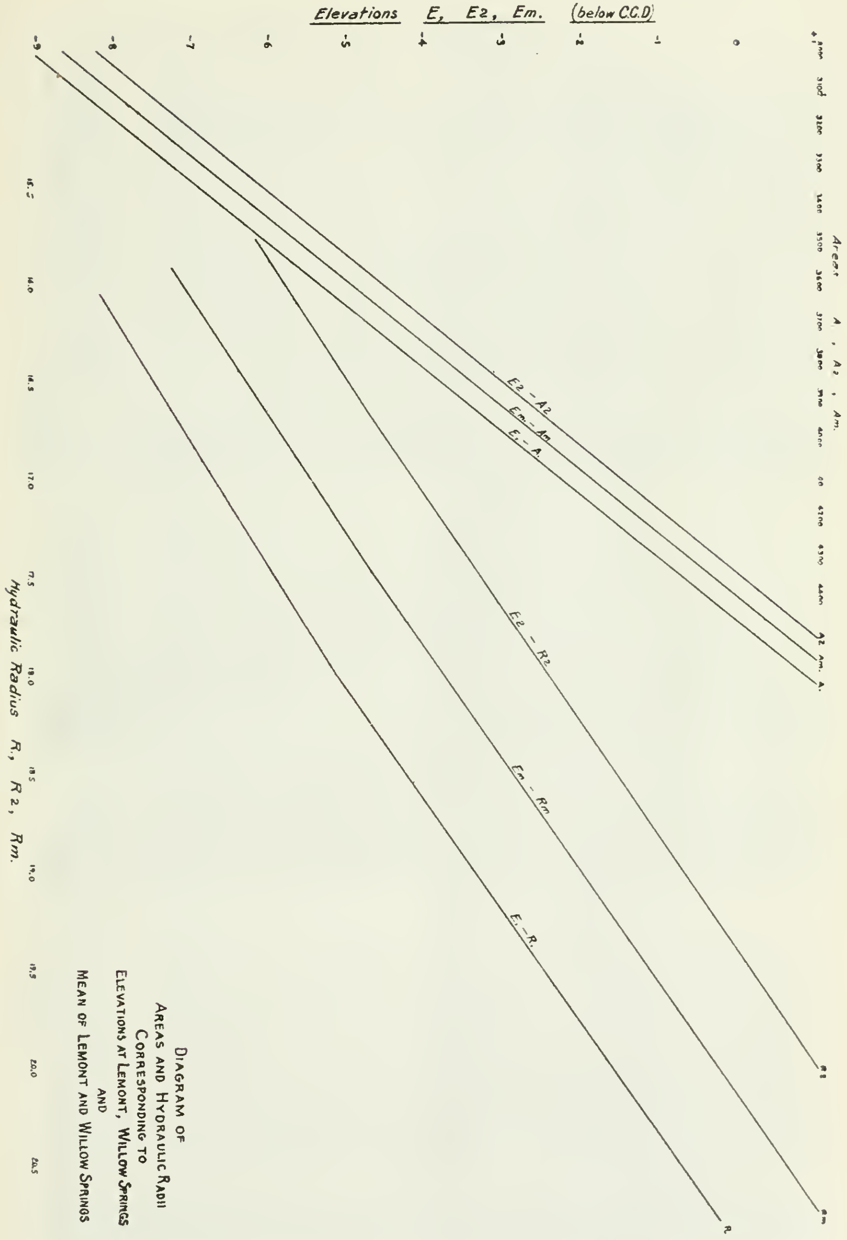

Elevations E, E2, Em. (below C.C.D)
-9
-8
-7
-6
-5
-4
-3
-2
-1
0
+1
Areas A, A2, Am.
3000
3100
3200
3300
3400
3500
3600
3700
3800
3900
4000
00
4200
4300
4400
A2
Am.
A.
E2 - A2
Em. - Am
E, - A.
E2 - R2
Em - Rm
E, - R.
R2
Rm
R.
Hydraulic Radius R, R2, Rm.
15.5
16.0
16.5
17.0
17.5
18.0
18.5
19.0
19.5
20.0
20.5
Diagram of
Areas and Hydraulic Radii
Corresponding to
Elevations at Lemont, Willow Springs
and
Mean of Lemont and Willow Springs

Fig. 23

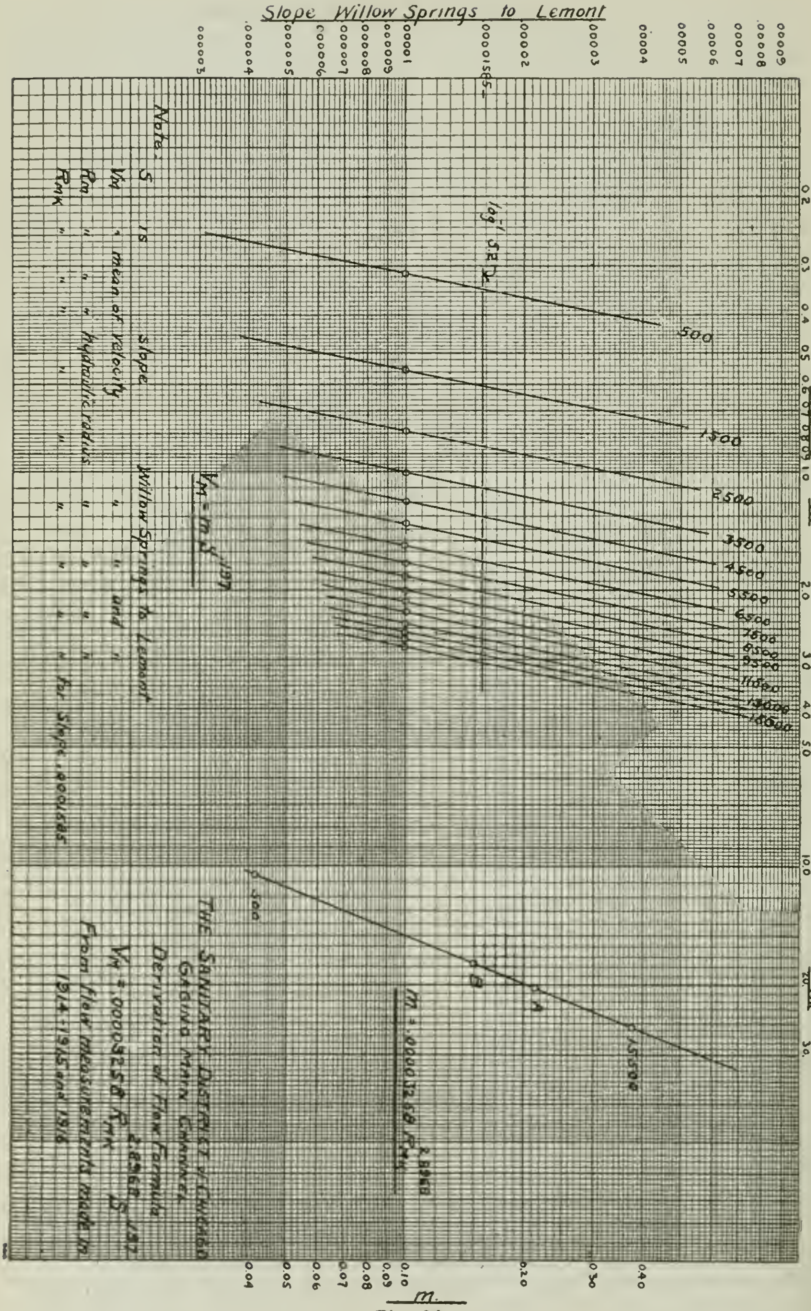

Slope Willow Springs to Lemont
.000003
.000004
.000005
.000006
.000007
.000008
.000009
.00001
.00001585
.00002
.00003
.0004
.0005
.0006
.0007
.0008
.0009
Velocity Vm
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1.0
2.0
3.0
4.0
5.0
10.0
Rmk
20.
30.
log⁻¹ S.197
500
1500
2500
3500
4500
5500
6500
7500
8500
9500
11500
13000
15500
Note.
S is slope Willow Springs to Lemont
Vm " mean of velocity " and "
Rm " " " hydraulic radius " " "
Rmk " " " " " " " for slope .0001585
Vm = m S.197
500
B
A
15500
m = .00003258 Rmk 2.8962
THE SANITARY DISTRICT of CHICAGO
GAGING MAIN CHANNEL
Derivation of Flow Formula
Vm = .00003258 Rmk 2.8962 S.197
From flow measurements made in
1914-1915 and 1916
0.04
0.05
0.06
0.07
0.08
0.09
0.10
0.20
0.30
0.40
m.

Fig. 24

Computation:

Obs. No.	Q	E_1	E_2	Obs. No.	Q	E_1	E_2
163	9810	424	290	76	5435	2.55	2.12
162	10395	407	270	7	5760	2.59	2.17
168	10280	443	310	11	5750	2.99	2.60
Mean				Mean			
162				7	5755	2.79	2.38
148	10377	425	290	11			
163	9810	424	290	76	5435	2.55	2.12
Wtd. Mean	10074	425	290	Wtd. Mean	5595	2.67	2.25

GROUP A.

			log.
1	Q	10074.	4.00321
2	E_1	4.25	
3	E_2	2.90	
4	E_M	3.57	
5	A_M	3825.	3.58263
6	R_M	18.13	
7	V_M	2.634	0.42058
8	S	.0000347	5.54033
9	.197 log. S		1.09144
10	log. m		9.32915
11	V_{MK}		0.35355
12	A_{MK}	4463.	3.64966
13	R_{MK}	20.38	1.30920
14	n	.0275	

GROUP B.

			log.
1	Q	5595.	3.74780
2	E_1	2.67	
3	E_2	2.25	
4	E_M	2.46	
5	A_M	4010.	3.60314
6	R_M	18.77	
7	V_M	1.355	0.14466
8	S	.0000108	5.03342
9	.197 log. S		9.99153
10	log. m		9.15308
11	V_{MK}		0.17748
12	A_{MK}	3718.	3.57032
13	R_{MK}	17.74	1.24895
14	n	.037	

September 5, 1920

TABLE XIV.

SLOPES IN ROCK SECTION MAIN CHANNEL.

Slope per foot	Fall Willow Springs to Lemont dist. = 38900		Fall Lemont to Lockport dist. = 36230		Fall Willow Springs to Lockport dist. = 75130	
	From	To	From	To	From	To
.000001	0.02	0.05	0.02	0.05	0.04	0.11
2	.06	.09	.06	.09	.12	.18
3	.10	.13	.10	.12	.19	.26
4	.14	.17	.13	.16	.27	.33
5	.18	.21	.17	.19	.34	.41
6	.22	.25	.20	.23	.42	.48
7	.26	.28	.24	.27	.49	.56
8	.29	.32	.28	.30	.57	.63
9	.33	.36	.31	.34	.64	.70
10	.37	.40	.35	.38	.71	.78
11	.41	.44	.39	.41	.79	.86
12	.45	.48	.42	.45	.87	.93
13	.49	.52	.46	.48	.94	1.01
14	.53	.56	.49	.52	1.02	1.08
15	.57	.60	.53	.56	1.09	1.16
16	.61	.64	.57	.59	1.17	1.23
17	.65	.68	.60	.63	1.24	1.31
18	.69	.71	.64	.66	1.32	1.38
19	.72	.75	.67	.70	1.39	1.46
20	.76	.79	.71	.74	1.47	1.53
21	.80	.83	.75	.77	1.54	1.61
22	.84	.87	.78	.81	1.62	1.68
23	.88	.91	.82	.85	1.69	1.76
24	.92	.95	.86	.88	1.77	1.83
25	.96	.99	.89	.92	1.84	1.91
26	1.00	1.03	.93	.95	1.92	1.99
27	1.04	1.06	.96	.99	2.00	2.06
28	1.07	1.10	1.00	1.03	2.07	2.14
29	1.11	1.14	1.04	1.06	2.15	2.21
30	1.15	1.18	1.07	1.10	2.22	2.29
31	1.19	1.22	1.11	1.14	2.30	2.36
32	1.23	1.26	1.15	1.17	2.37	2.44
33	1.27	1.30	1.18	1.21	2.45	2.51
34	1.31	1.34	1.22	1.24	2.52	2.59
35	1.35	1.37	1.25	1.28	2.60	2.66
36	1.38	1.41	1.29	1.32	2.67	2.74
37	1.42	1.45	1.33	1.35	2.75	2.81
38	1.46	1.49	1.36	1.39	2.82	2.89
39	1.50	1.53	1.40	1.42	2.90	2.96
.000040	1.54	1.57	1.43	1.46	2.97	3.04

No of Obs. Avg'd	Group	Centers of Gravity of Trial Dischg Lines				Variation from Chart	
		Upper set of Obs.		Lower set of Obs.			
		Observed c.f.s.	Chart 180 c.f.s.	Observed c.f.s.	Chart 180 c.f.s.	Actual c.f.s.	Per Cent. %
1	5500	5435	5850			+ 415	+ 7.1
0	5500			—	—	—	
1	5700	5760	5750			− 10	− 0.2
1	5700			5750	5200	− 550	− 10.7
1	6100	6180	6650			+ 550	+ 8.3
0	6100	—	—	—	—	—	
1	6500	6535	5950			− 585	− 9.8
1	6500			6455	7150	+ 695	+ 9.7
1	6700	6750	6300			− 450	− 7.1
1	6700			6610	6500	− 110	− 1.7
2	6900	6925	6350			− 575	− 9.1
2	6900			6970	6975	+ 5	+ 0.1
3	7100	7075	6800			− 275	− 4.0
2	7100			7110	7235	+ 125	+ 1.7
4	7300	7370	7140			− 230	− 3.2
3	7300			7370	7285	− 85	− 1.2
4	7500	7480	7300			− 180	− 2.5
7	7500			7490	7500	+ 10	+ 0.1
1	7500	7495	7450			− 45	− 0.6
5	7700	7650	7650			00	0.0
6	7700			7660	7550	− 110	− 1.5
4	7900	7860	7950			+ 90	+ 1.1
7	7900			7910	7700	− 210	− 2.7
4	8100	8150	8200			+ 50	+ 0.6
5	8100			8095	8000	− 95	− 1.2
3	8300	8280	8500			+ 220	+ 2.6
4	8300			8280	8400	+ 120	+ 1.4
2	8500	8510	9300			+ 790	+ 8.5
2	8500			8520	8500	− 20	− 0.2
1	8700	8630	8100			− 530	− 6.5
1	8700			8630	9500	+ 870	+ 9.2
1	8900	8845	9000			+ 155	+ 1.7
0	8900			—	—	—	
1	9300	9300	9500			+ 200	+ 2.1
0	9300			—	—	—	
1	9700	9615	9200			− 415	− 4.5
1	9700			9675	9400	− 275	− 2.9
1	9900	9810	10250			+ 440	+ 4.3
0	9900			—	—	—	
1	10300	10395	10650			+ 245	+ 2.3
1	10300			10280	9950	− 330	− 3.3
				Sum of 35 obs		− 100	− 12.1
				Mean		− 3	− 0.3

Fig. 25

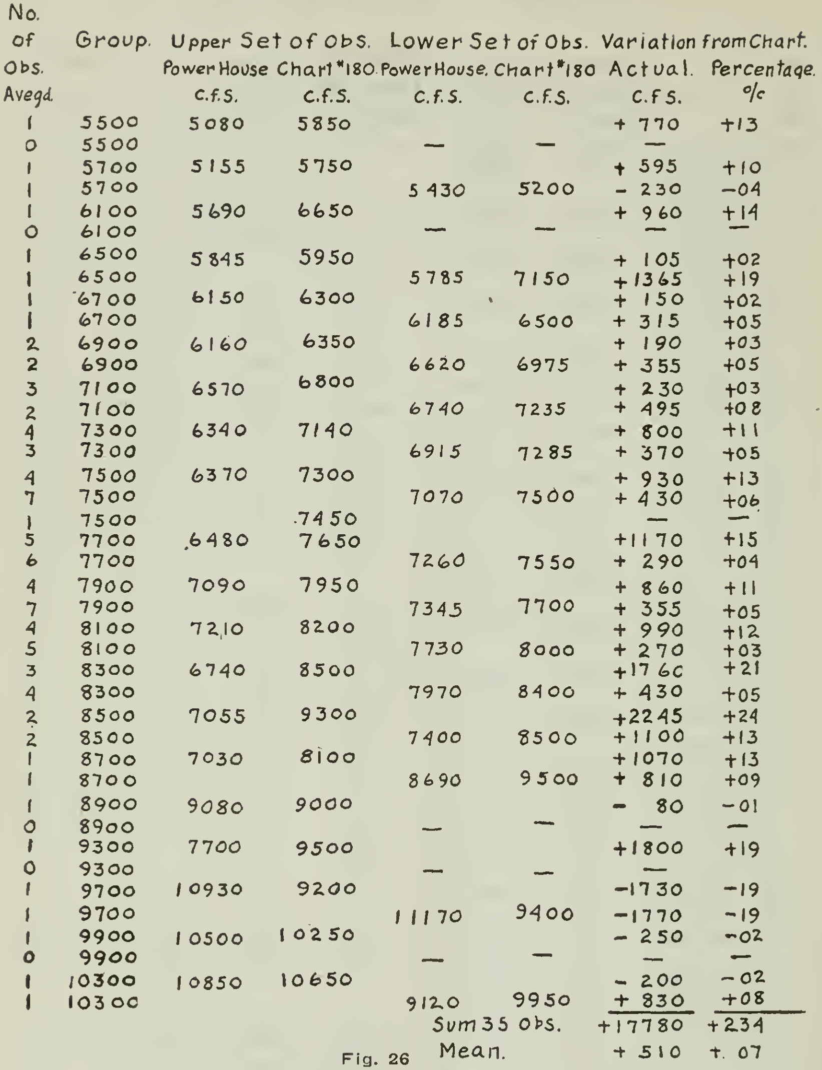
COORDINATES.

	log m	log R_{MK}
A	9.32915	1.30920
B	9.15308	1.24895

The equation of a straight line through A and B (Fig. 24) is

$$\log m = 2.922\, R_{MK} + 5.50367$$

The line traced through the points, log m, log R_{MK}, of all of the groups of discharges is a very flat curve to which a straight line



No. of Obs. Avegd.	Group.	Upper Set of Obs.		Lower Set of Obs.		Variation from Chart.	
		Power House C.f.S.	Chart *180 C.f.S.	Power House. C.f.S.	Chart *180 C.f.S.	Actual. C.f.S.	Percentage. %
1	5500	5080	5850			+ 770	+13
0	5500			—	—	—	
1	5700	5155	5750			+ 595	+10
1	5700			5430	5200	− 230	−04
1	6100	5690	6650			+ 960	+14
0	6100			—	—	—	—
1	6500	5845	5950			+ 105	+02
1	6500			5785	7150	+1365	+19
1	6700	6150	6300			+ 150	+02
1	6700			6185	6500	+ 315	+05
2	6900	6160	6350			+ 190	+03
2	6900			6620	6975	+ 355	+05
3	7100	6570	6800			+ 230	+03
2	7100			6740	7235	+ 495	+08
4	7300	6340	7140			+ 800	+11
3	7300			6915	7285	+ 370	+05
4	7500	6370	7300			+ 930	+13
7	7500			7070	7500	+ 430	+06
1	7500		7450			—	—
5	7700	6480	7650			+1170	+15
6	7700			7260	7550	+ 290	+04
4	7900	7090	7950			+ 860	+11
7	7900			7345	7700	+ 355	+05
4	8100	7210	8200			+ 990	+12
5	8100			7730	8000	+ 270	+03
3	8300	6740	8500			+1760	+21
4	8300			7970	8400	+ 430	+05
2	8500	7055	9300			+2245	+24
2	8500			7400	8500	+1100	+13
1	8700	7030	8100			+1070	+13
1	8700			8690	9500	+ 810	+09
1	8900	9080	9000			− 80	−01
0	8900			—	—	—	—
1	9300	7700	9500			+1800	+19
0	9300			—	—	—	
1	9700	10930	9200			−1730	−19
1	9700			11170	9400	−1770	−19
1	9900	10500	10250			− 250	−02
0	9900			—	—	—	—
1	10300	10850	10650			− 200	−02
1	10300			9120	9950	+ 830	+08
				Sum 35 Obs.		+17780	+234
				Mean.		+ 510	+.07

Fig. 26

is a sufficiently close approximation. Revised values of log m obtained from this equation, for each group of discharges were used in obtaining the adjusted curves representing the relation log S — log V_M, that is, the equation

$$\log V_M = \log m + .197 \log S$$

substituting in this equation for log m we have

$$\log V_M = 2.922 \log R_{MK} + 5.50367 + .197 \log S$$

which reduces to

$$V_M = .000032\, R_{MK}^{2.922}\, S^{.197}$$

a formula for uniform flow in the rock section of the main channel.

The points for plotting the series of lines represented by this formula were obtained by assuming for each discharge line various velocities, dividing the discharge by the velocity gave the area (A_M) for which the corresponding elevation (E_M) was scaled from the diagram. The slope corresponding to the assumed velocity was scaled. The fall for this slope is taken from Table XIV. Adding half the fall to E_M gives E_1, and subtracting it from E_M gives E_2.

Example:

For Q	7900	
and V	2	
A	3950	Q/V
E_M	2.80	Plate No. 191
log. S	5.80	Plate No. 189 for V = 2.00
S	.000019	
F	.74	Table No. 8
E_1	3.17	$E_M + F/2$
E_2	2.43	$E_M - F/2$

(E_1, E_2) = (3.17, 2.43) is a point on the 7900 curve, Fig. 22.

When E_1 and E_2 are observed the discharge is taken directly from Fig. 22.

The mean of all the variations of the centers of gravity of discharge groups (Table XII) from the discharge curves, Chart or Fig. 22, is 0.3%, Figs. 25 and 26.

Upon opening of the Sag Canal, in order to apply the formula here derived, it will be necessary to establish a gage below the intersection with the main channel and derive elevations of the water surface to replace E_2.

APPLICATION OF EMPIRICAL FORMULÆ

Kutter's Formula:

$$c = \frac{41.65 + \frac{0.00281}{S} + \frac{1.811}{n}}{1 + \frac{n}{\sqrt{R}}\left(41.65 + \frac{0.00281}{S}\right)}$$ for determination

c in the Chezy formula $V = c\sqrt{RS}$

Values of n were computed and tabulated for each of the discharges (Table XV). It will be noted that for any discharge ± 200 c. f. s. that n is practically constant for all slopes and hydraulic radii and that it increases with the decrease in discharge, Fig. 27. In other words this formula does not apply in this channel.

Manning's Formula:

This gives for c in the Chezy formula

$$c = \left(\frac{1.486}{n}\right) R\ 1/6$$

Values of n for this formula were also computed and tabulated for each of the discharges, Table XV.

Here n is practically constant for all observations except the very low discharges.

The inconsistency of the curves at the very low discharges in the application of both formulæ may be due to the discharge-stage relation not being as accurately determined as for the higher discharges.

TABLE XV.

Obs. No.	Q Observed	S	Vm	Rm	Kutter "n"	Manning "n"
76	5435	.000011	1.34	18.84	.038	.026
Mean	5435				.038	.026
7	5760	.000011	1.44	18.71	.036	.024
11	5750	.000010	1.46	18.58	.034	.023
Mean	5755				.035	.023
131	6180	.000012	1.50	19.11	.036	.024
Mean	6180				.036	.024
47	6535	.000010	1.58	19.24	.032	.021
81	6455	.000014	1.59	18.92	.035	.025
Mean	6495				.0335	.023
65	6750	.000010	1.62	19.38	.032	.021
86	6610	.000013	1.68	18.49	.032	.022
Mean	6680				.032	.0215
49	6900	.000010	1.65	19.35	.032	.021
129	6950	.000010	1.67	19.26	.032	.020
56	6985	.000013	1.70	19.09	.032	.022
121	6955	.000012	1.72	18.91	.032	.021
Mean	6950				.032	.021
60	7125	.000011	1.70	19.42	.031	.021
62	7095	.000012	1.71	19.22	.032	.022
55	7000	.000013	1.70	19.12	.032	.023
94	7130	.000015	1.79	18.61	.032	.023
85	7090	.000016	1.79	18.61	.032	.023
Mean	7090				.032	.022
147	7365	.000012	1.77	19.38	.030	.021
132	7380	.000013	1.77	19.30	.031	.022
122	7335	.000014	1.81	18.92	.030	.022
130	7390	.000015	1.82	18.92	.032	.022
20	7280	.000016	1.84	18.58	.032	.022
23	7425	.000017	1.90	18.44	.031	.023
108	7410	.000020	1.91	18.36	.032	.024
Mean	7370				.031	.022

TABLE XV.—Continued

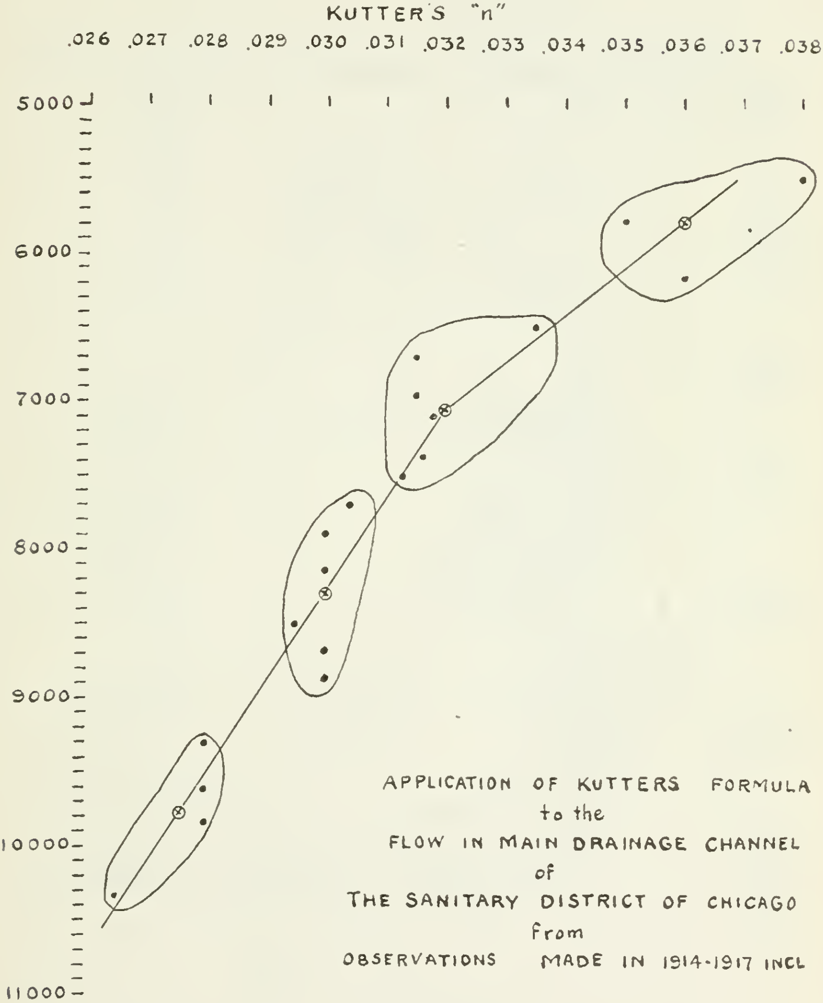
Obs. No.	Q Observed	S	Vm	Rm	Rutter "n"	Manning "n"
165	7430	.000014	1.77	19.43	.032	.022
152	7580	.000012	1.82	19.30	.029	.020
137	7440	.000014	1.81	19.09	.031	.022
139	7440	.000014	1.81	19.12	.031	.022
24	7460	.000015	1.81	18.61	.030	.021
43	7560	.000017	1.92	18.58	.030	.022
19	7430	.000016	1.90	18.44	.030	.022
92	7430	.000019	1.90	18.38	.032	.024
111	7435	.000019	1.90	18.38	.032	.024
120	7515	.000021	1.94	18.28	.033	.024
84	7550	.000020	1.96	18.26	.032	.023
83	7500	.000021	1.95	18.17	.033	.024
1	7495	.000026	2.06	18.50	.032	.025
Mean	7480				.031	.023
153	7745	.000015	1.86	19.31	.031	.022
138	7680	.000014	1.88	19.07	.030	.021
142	7740	.000014	1.90	19.05	.030	.021
32	7655	.000015	1.90	18.80	.029	.021
110	7605	.000019	1.92	18.61	.032	.024
39	7770	.000018	1.96	18.60	.031	.023
18	7600	.000015	1.94	18.50	.028	.021
113	7780	.000021	2.00	18.34	.032	.024
88	7600	.000019	1.98	18.21	.030	.023
87	7605	.000020	1.98	18.17	.031	.024
Mean	7680				.031	.022
164	7805	.000014	1.86	19.46	.030	.022
163	7990	.000015	1.94	19.17	.030	.021
116	7840	.000020	1.97	18.62	.032	.024
40	7815	.000017	1.96	18.56	.030	.022
33	7925	.000019	2.02	18.50	.030	.022
126	7905	.000021	2.00	18.56	.031	.024
106	7840	.000020	2.00	18.45	.031	.023
35	7860	.000017	2.00	18.44	.029	.021
34	8095	.000021	2.12	18.15	.029	.022
101	7915	.000020	2.07	18.14	.029	.022
98	7820	.000022	2.04	18.13	.029	.024
Mean	7890				.030	.022

TABLE XV.—Continued

Obs. No.	Q Observed	S	Vm	Rm	Kutter "n"	Manning "n"
144	8180	.000016	2.14	19.21	.027	.020
105	8140	.000020	2.07	18.51	.030	.022
127	8210	.000023	2.10	18.46	.031	.024
100	8080	.000019	2.08	18.38	.029	.022
107	8080	.000021	2.09	18.28	.030	.023
99	8105	.000021	2.10	18.24	.030	.020
96	8215	.000023	2.14	18.21	.030	.023
118	8005	.000023	2.10	18.12	.030	.023
115	8060	.000024	2.11	18.12	.031	.024
97	8095	.000024	2.12	18.07	.031	.024
117	8170	.000026	2.16	17.96	.031	.024
Mean	8120				.030	.023
156	8230	.000016	1.98	19.45	.030	.021
158	8360	.000017	2.02	19.45	.030	.022
160	8245	.000015	2.00	19.29	.029	.021
167	8200	.000022	2.07	18.60	.031	.024
44	8335	.000020	2.11	18.57	.029	.022
95	8260	.000021	2.11	18.47	.029	.023
124	8335	.000024	2.15	18.28	.030	.023
Mean	8280				.030	.022
159	8470	.000017	2.00	19.52	.030	.022
155	8545	.000018	2.03	19.45	.030	.023
149	8545	.000019	2.10	18.96	.029	.022
102	8500	.000023	2.21	18.18	.029	.022
Mean	8500				.0295	.022
150	8630	.000019	2.10	18.96	.029	.022
168	8630	.000025	2.17	18.62	.031	.024
Mean	8630				.030	.023
166	8845	.000032	2.36	17.81	.030	.024
Mean	8845				.030	.024
157	9300	.000018	2.20	19.59	.028	.021
Mean	9300				.028	.021
72	9615	.000042	2.71	17.13	.028	.024
74	9675	.000045	2.75	17.03	.028	.023
Mean	9645				.028	.023
163	9810	.000034	2.56	18.13	.028	.023
Mean	9810				.028	.023
162	10395	.000035	2.70	18.24	.027	.023
148	10280	.000034	2.71	18.02	.026	.022
Mean	10290				.0265	.0225

It would thus appear that this formula does apply in this channel and its mean value is .022, Fig. 28.

A discussion and further application of this formula is given in King's Hydraulics.



APPLICATION OF KUTTERS FORMULA
to the
FLOW IN MAIN DRAINAGE CHANNEL
of
THE SANITARY DISTRICT OF CHICAGO
from
OBSERVATIONS MADE IN 1914-1917 INCL

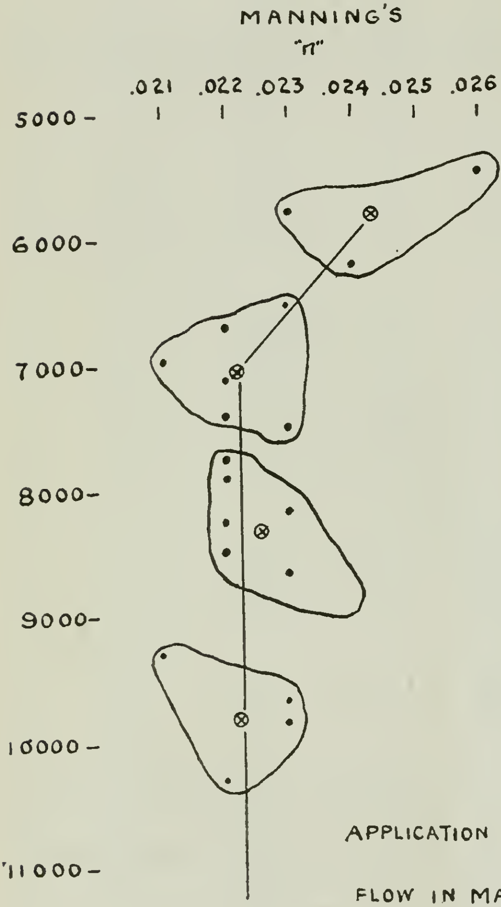
Fig. 27

COMPARISON OF RESULTS.

On Fig. 29 the current meter discharges and the Power House discharges are compared to (Fig. 22) the discharge-stage relation derived from the writer's formula.

It is seen that the Power House is generally less than the other determinations, also that the discrepancy varies in different seasons.

The same comparison is made on Fig. 30 according to the amount of discharge. The discrepancy is shown more clearly at the bottom of the plate where percentages are used. Here the discrepancy is practically constant up to 9500 c. f. s. and irregular above.



APPLICATION OF MANNING'S FORMULA
TO THE
FLOW IN MAIN DRAINAGE CHANNEL
OF THE
SANITARY DISTRICT OF CHICAGO
FROM
OBSERVATIONS MADE IN 1914-1917 INCL.

Fig. 28

This would indicate that the cause was in the hydraulic machinery rather than in the portion of the flow over the dams.

An allowance for leakage is made in all the calculations of the turbine discharge. It would appear that this allowance is insufficient.

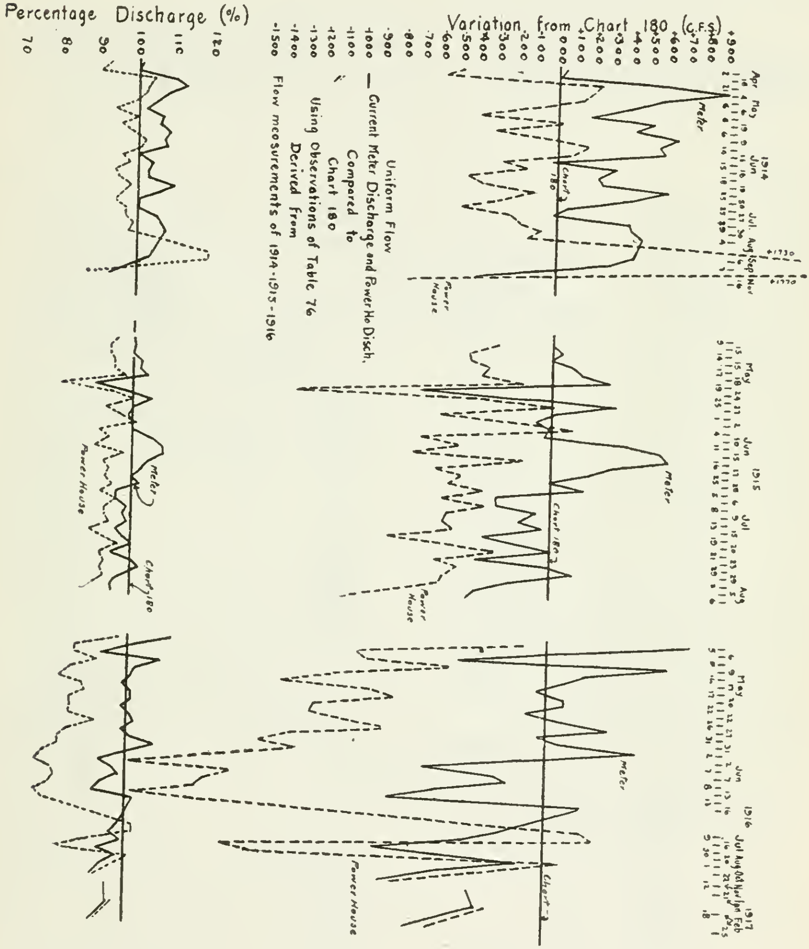


Fig. 29

Since 1916 some of the turbines have been overhauled so that it is possible that a closer agreement with the deduced discharge-stage relation, such as obtained in 1914, may now exist.

These investigations were made under the most favorable auspices. The Sanitary District desired a thorough and careful study of the flow and authorized the procurement of any necessary apparatus or other means to procure reliable results.

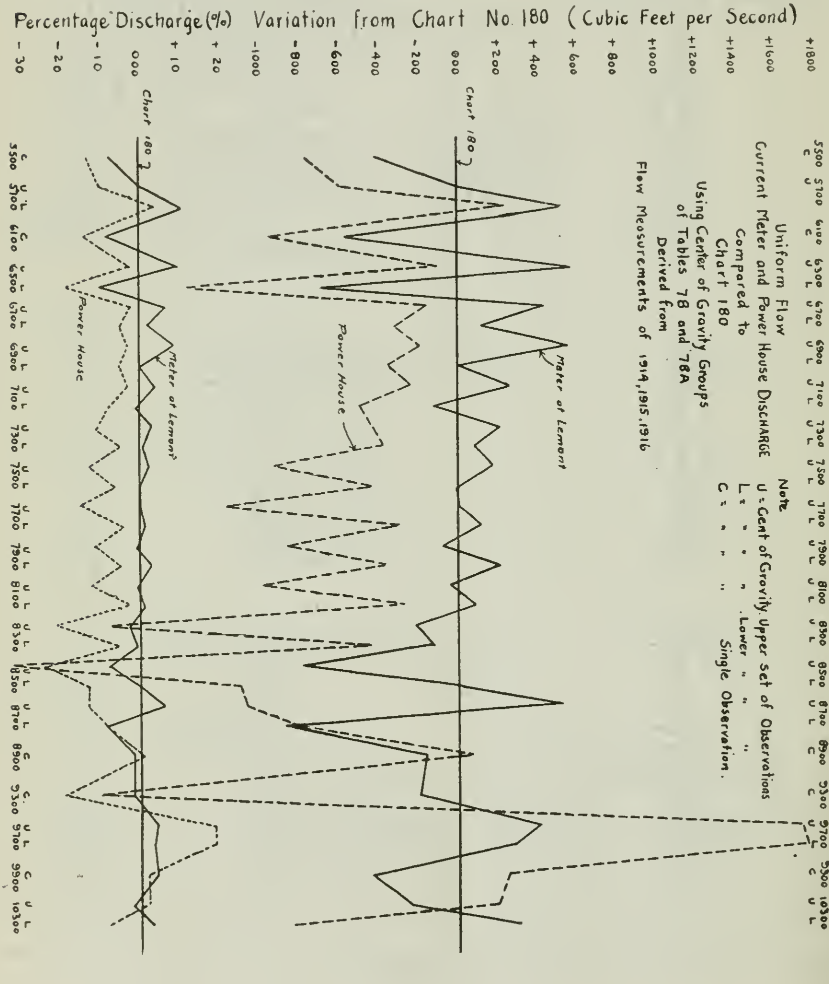


Fig. 30

CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY OF ENGINEERS

Volume XXV OCTOBER, 1920 Number 14

Western Society of Engineers' Journal on Monthly Basis

A magazine is worth more than its old-paper-stock value only as it is read—as its contents have interest and value for its subscribers. The new JOURNAL policy inaugurated this year has made it more readable and more representative of the Society's activities, and has placed less emphasis upon making permanent record of technical papers delivered before the Society.

The Board and the Publication Committee have felt, however, that the JOURNAL should not attempt to follow the lead of the weekly engineering press, with respect to current happenings, that it should omit news properly appearing in those periodicals and devote its pages more exclusively to Society activities, particularly committee work. It was decided also that technical papers chosen for printing might well be fewer in number,—the criterion of choice being their interest to the entire membership.

With these ends in view the JOURNAL will become a monthly beginning with the October issue. It will give less attention to matters of general engineering interest fully covered in the weekly engineering press. It will give immediate report of the month's meetings. It will keep the membership completely in touch with the work of each committee. It will contain in full such technical papers as are of certain general interest to the membership and will revise for brevity or digest others. In shorter form they should be more generally readable and for those requiring the full version, complete. Copies of each paper with discussion, will be on file in the library.

The change to a monthly basis is logical in view of the nature of the work of the Committees. Results are not quick,—are the results of months of activity and a less frequent summary of work will be more valuable than fragmentary reports. Incidentally the cost of printing the JOURNAL will be reduced and the savings applied where the membership will be most benefited.

A business is successful or otherwise as the management is resourceful and able—for this reason the Committee on Publications believes that in the choice of a capable editor and manager of the JOURNAL its success is assured.

Mr. C. L. Ozburn has been engaged to take charge of our JOURNAL. His previous experience and proved ability is given whole heartedly to this work, and with the support of the interested members of the Society will produce a JOURNAL we can well be proud of.

PUBLICATION COMMITTEE.

A. S. C. E. Proceedings

In the Auugust, 1920, number of the publication of the proceedings of the American Society of Civil Engineers a decided change in style was inaugurated. Due to the increased cost of paper, labor, etc., it was deemed necessary to economize. The new form is a slightly wider type page and a corresponding reduction in margin. The result is most pleasing.

Report of Hydraulic, Sanitary and Municipal Engineering Section

The Executive Committee of this section held a meeting August 11 at which time consideration was given to your communication and General Black's criticism of Chicago's municipal works and projects. It was the feeling of the committee that the questions involved in General Black's criticism are so broad in their scope and so important to the community that it cannot in itself pass upon them adequately.

The engineering profession has for several years past been looking forward for an opportunity to take its place among active civic organizations and to assist in the solution of the many technical problems of the day, and our committee feels that such an opportunity is now offered to the Western Society of Engineers through these criticisms of General Black.

We suggest that the Western Society of Engineers accept the opportunity and take upon itself the responsibility of creating in the minds of the citizens a healthy respect for and demand for correct information on the big technical municipal problems now confronting us.

The two principal criticisms which are of direct interest to the hydraulic, sanitary and municipal section are those on the water supply and sewage disposal though closely linked with them is the one of navigation and harbor facilities. This committee recognizes that the society of itself has no financial resources to undertake this work, and we therefore recommend that the Board of Direction of the Western Society of Engineers select a committee, made up of the most influential of its members, to canvass all organizations interested in these problems, such as the Chicago Association of Commerce, the Chicago Real Estate Board, the finance committee of the City of Chicago, the Sanitary District, the Bureau of Public Efficiency, etc., asking them to co-operate with the society financially in the conduct of the investigation and preparation of reports.

We feel that a more unbiased report and one which will be readily accepted as authentic by the public can be made under the direction of the Western Society of Engineers than can be done by any other local agency.

It is not our idea that engineers be asked to give their services gratuitously to such work, but rather that it be carried on by a well organized and expert staff, hence the need of a considerable fund, perhaps as much as $100,000.

The fund thus collected can be placed at the disposal of a central committee composed of a member or representative from each of the contributing organizations. This central committee also to assist in securing available data for use of the experts and to have general direction in connection with the investigation and report.

If this scheme, as briefly outlined, is found to be feasible and adopted, then we further recommend that the selection of the experts be made by a committee from this society appointed by the Board of Direction. It is also our recommendation that the Western Society of Engineers generally supervise the preparation of the report, its printing and distribution and keep such control of the entire work as will make the report truly a contribution from the Western Society of Engineers to the community.

We believe such a program while more or less an innovation for the Western Society of Engineers is along the line which progressive engineering development should follow and if wisely administered will be a very material step in having engineers lead in engineering matters.

Engineering Foundation

To Members and Friends of the Engineering Societies:

Necessity for more and better and continuing research in the engineering field and the benefits to be derived are admitted by all well-informed persons. Research pays; but in some cases not so immediately that an individual or a company of moderate resources can undertake it. Material needs created by advancing standards of living must be met largely by progress in the sciences and in engineering and other branches of technology. For six years there has existed an organization created by the Founder Societies to stimulate and oversee research for engineers.

Engineering foundation, based on a trust fund established by the United Engineering Society from gifts of Ambrose Swasey and other donors, is the central research organization for the engineering profession. With an income of $10,000 for three years and $15,000 for three years, Engineering Foundation has:

1. Aided in establishing National Research Council and in supporting its division of engineering;
2. Financed an investigation of fatigue phenomena of metals, now in progress, in which a leading industrial corporation has recently joined, making a large financial contribution;
3. Financed a hydraulic research which resulted in an improved weir with a straight-line formula;
4. Participated in a study of spray camouflage of ships;
5. Supported a study in mental hygiene of industry;
6. Compiled for National Research Council a classified directory of industrial research laboratories in the United States;
7. Financed tests of wear of gears, now in progress;
8. Investigated practicability of a testing station for large water wheels and other large hydraulic equipment;

Numerous large and important research projects which promised valuable results could not be undertaken because of lack of funds.

Enterprising corporations are each spending hundreds of thousands, and, in several cases, millions every year for research in their restricted fields of industry. Engineering Foundation desires to serve the nation and the engineering profession adequately, but to do so must have adequate resources. It renders full account of its monies and reports the work done. It seeks increase of its endowment. It has $300,000, with assurance of $250,000 more. The first million should be rounded out this year and other millions should follow. A gift for research is a productive investment.

Pecuniary gains from research go most directly to the industries, therefore the industries should contribute to the support of engineering research. Thousands of engineers are connected with the industries.

Gifts of $1,000 or more are desired. If you cannot give, please make a real effort to interest men who can. Each person giving $250,000 or more will be honored as a founder.

A booklet about Engineering Foundation and further information will be sent upon request.

Charles F. Rand, Chairman,
71 Broadway, New York.
Alfred D. Flinn, Secretary,
29 West 39th street, New York.

September Meeting of the Board of Direction

REPORTS OF COMMITTEES

Report of the Executive Committee of the Hydraulic, Sanitary and Municipal Engineering Section, outlining a progressive step for the Society was presented and is published elsewhere in this JOURNAL for the information of our members.

A report of the Development Committee was also received and will be found in this issue of the JOURNAL.

Federal Water Power Commission

As a result of the conference between the Water Power Commission and outside agencies the proposed regulations were for the most part approved in the form which they had been written by the Commission, after they had been explained or interpreted by the Secretary, Mr. O. C. Merrill. It was agreed after discussion to change Regulation 4, Sections 5, 7 and 9, so that only general information covering surveys, power plant and transmission equipment would be required in preliminary application. The necessity of adjusting and standardizing State and Federal laws was stressed. The financial conference centered entirely about an effort by financial houses to stress with the Commission the importance of making terms of the regulations such that proposed projects could be financed on better than 7 per cent basis, due to the prevailing high money rates. A hearing will be held on August 24th covering plans for development of the Great Falls project of the Potomac River.

Denver Meeting of the League of the Southwest

R. M. Hosea,
M. W. Soc. Engrs., Denver, Colo.

In the Official Bulletin published by the Colorado Society of Engineers appeared an editorial on the League of the Southwest. R. M. Hosea, M. W. S. E., has written for the Journal an outline of a recent meeting of this League which I am sure will interest a great many members of the W. S. E. —Editor.

At the Denver meeting of the league, there were discussed some of the most vital and far reaching questions affecting the future development and welfare of Colorado (and indeed of the Western United States) that we have ever listened to. Some of them may involve interpretations of our Federal Constitution as important as the celebrated ones of John Marshall.

One of them involves a compact or agreement among seven states, claiming treaty right requiring the consent of Congress and legislation by the several states and a possible Supreme Court decision.

Another question discussed was the menace of Oriental immigration into these states. This question came up under the ruling of the chairman that "this was an open forum" to discuss social and economic questions affecting the league.

Another interesting question was suggested by Attorney Delph E. Carpenter, honorary member the Colorado Society of Engineers, who said that Colorado desired "to live and let live" in asserting its constitutional rights of appropriation of water. Heretofore, however, we had been placed on the defensive and obliged to go into court, making large appropriations to a "defense fund" with each legislative session. It was a relief, he said, "to know that a conference before war" was to be the policy of the league.

And incidentally it might be mentioned that the defense fund has been a source of revenue to our irrigation lawyers and engineers for some years past and has brought out some very brilliant engineering and legal work in water matters that have greatly advanced the art, and been of immense benefit to both fraternities.

Director A. P. Davis of the U. S. reclamation service, in his address assured the delegates that his investigations had shown that there was ample water in the Colorado river basin for all the power, storage and irrigation needs of the states in whose boundaries the streams rise, including such possible diversions to the east slope in Colorado as might be made; he also explained that the controlling factor on the lower river was the Boulder Canon dam—400 ft. or more in height—which would control the floods and furnish power and irrigation for the Imperial valley and other units to be irrigated in the United States and Mexico. At the same time the question of overflow protection, and so forth, would be solved above the mouth of the Gila, this stream being a separate problem. His address also touched on the question of the silting up of such reservoirs as this and the Elephant buttes dam project. He explained a suggested method of remedying this loss of storage by constructing dams in series above, which would be utilized to wash away the great deposits of the lower reservoir, while maintaining the necessary irrigation flow partly from the saturated mass of silt.

Acting under Mr. Davis' declaration that there was ample water for all uses, the following resolution was adopted: Whereas, it is the understanding of this league from information presented by Hon. Arthur P. Davis, Director of the U. S. reclamation service that the water supply of the Colorado river drainage is sufficient to supply the present and future necessities of all the states whose territory is involved; and that all present and future interference with development upon or from the upper reaches of the stream should be avoided, now therefore be it Resolved, That the league favors the early development of all possible beneficial uses of the waters of the stream and its tributaries, along the lines set forth in the resolutions adopted at the Salt Lake conference of Jan. 18-21, 1919; and that present and future restrictions upon such development by withholding or conditional granting of applications for rights of way across public lands for irrigation works should be discontinued and that such applications should be granted with that degree of dispatch which will permit the construction of all such projects while financial and other means are at hand and opportunity for construction exists.

A further resolution providing for the organization of The Colorado River Commission, was adopted as follows: Resolved, that the state engineers and officers having authority over the initiation of water rights in the seven states included in the Colorado river basin, together with the director and Chief Engineer of the U. S. reclamation service, organize at this conference a permanent engineering commission to be called The Colorado River Commission, whose duty it shall be to study the Colorado river basin as a whole and prepare a comprehensive plan for immediate action and early development; and further that said commission shall elect a chairman and secretary and meet from time to time at the call of the chairman for the purpose of considering the problems before it; and be it further Resolved, that the Governors of the several states are hereby requested to authorize and direct their state officers above mentioned to proceed with the organization above mentioned and with the necessary investigations.

This commission was organized at the close of the meeting with Mr. A J. McCune, State Engineer of Colorado, as chairman.

The question of "California and the Oriental" was discussed as noted resulting in the following resolution: Resolved, That we oppose further enlargement of agricultural holdings in the United States by citizens of any Oriental nation and that further discussion of that subject be placed upon the program of the next regular meeting of the league.

Under this short and simple resolution is concealed a large and complicated subject. We recommend a careful perusal of the Report of the State Board of Control of California to Gov. Wm. D. Stephens (a copy of which has been placed in the Colorado Society library) for a full and careful analysis of both sides of this question. It is of interest to irrigation engineers and to the student of social and economic questions, and to Americans generally.

One of the most fundamental questions is embodied in the main resolution, which one of the daily papers said "restores the treaty rights between the seven states interested—rights that have virtually become obsolete because of non-use."

This resolution forms the basis of the whole league and it may require a Supreme Court decision to bring about such an interpretation of our Federal Constitution as will permit of the formation of a league of states to exercise control of the waters of an inter-state and inter-national stream, even with the consent of Congress.

Undoubtedly Federal control of such a league must prevail. It presents an interesting problem for our constitutional lawyers to discuss. (See U. S. Cons., Sec. 10, pp. 1 and 3.)

Be It Resolved, That it is the sense of this Conference, that the present and future rights of the several states whose territory is in whole or in part included within the drainage area of the Colorado river, and the rights of the United States to the use and benefits of the waters of said stream and its tributaries, should be settled and determined by compact or agreement between said states and the United States, with consent of Congress; and that the Legislatures of said states be requested to authorize the appointment of commissioners for each of such states for the purpose of entering into such compact or agreement, for subsequent ratification and approval by the Legislatures of each of said states and the Congress of the United States.

Following the adoption of the report of the general committee on resolutions the conference adopted a resolution "requesting the congress of the United States to make forthwith such appropriations as may be found necessary by the U. S. reclamation service for a complete investigation and report of the water resources of the Colorado river basin and the utilization thereof."

Fred L. Lucas, Cons. Engr. of Colo., outlined the plans of The Western States Reclamation Service, composed of thirteen states and announced that a campaign for an appropriation of 250 million dollars for the completion of the various uncompleted reclamation projects was in progress. Mr. W. I. Drummond, managing director of the International Farm Congress, brought up a question of no less interest than those mentioned when he referred to the task of securing the appropriations necessary to enable the U. S. reclamation service to function properly in completing the projects under way and the development of others. He stated that the eastern agricultural states are against the further expenditure of government money for reclamation and it will require much educational and publicity work to convince the voters who elect congressmen in the more thickly populated eastern states of the benefits to the whole country of reclamation work. The war debt is a tremendous obstacle to be overcome also and the reclamation service itself is powerless to secure appropriations.

Interesting addresses were made by former Gov. E. M. Ammons and Geo. M. Bull, C. E. of Colorado, on the problems of the Colorado river and its headwaters, the former from the standpoint of one familiar with the early history of the agriculture and stock raising interests and the best means of conserving and using the water resources to their fullest possible extent.

The State Engineers of the seven states discussed the engineering problems connected with water appropriations in their states and showed how some of the proposed water developments had been affected by government action in the past, notably in the Pathfinder dam and Elephant Buttes dam cases, amounting in some cases to an embargo on further development, at the headquarters of some streams.

It was very pleasing to learn that such would not be the case with the Colorado river basin as respected its storage, power or irrigation possibilities, as was so fully demonstrated by Director Davis.

Colorado is also interested in several proposed diversions of water from the western to the eastern slope through tunnels, of which one or more of the three proposed state aid railroad tunnels may yet be modified to serve as carriers. For those who have investigated the possibilities of this source of water to supply some of the deficiency of flow on the eastern slope, it holds great attraction.

One such diversion from the Laramie and another from the Grand river are already in use to the Cache la Poudre river in Colorado and the Strawberry valley diversion in Utah to the Salt Lake valley is familiar, this being a U. S. reclamation project.

Taken as a whole the Denver meeting of the League of the Southwest marked a milestone of progress towards the solution of some great and important problems. The coal and petroleum needs of a large territory would be released by the power development of the Colorado river which is said to be capable of supplying all the railroad and other power requirements of the adjoining areas within economic reach. And this is only one item.

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Southern Section of the American Society *of* Agricultural Engineers Meets at Memphis

The southern section of the American Society of Agricultural Engineers held a two-day meeting in Memphis, Tenn., on August 30 and 31, devoting its attention to agricultural engineering problems as they are found in the South. Representatives from practically all of the southern states were in attendance, the agricultural colleges being particularly well represented. At the business session Stanley E. Morse, a consulting agricultural engineer of New Orleans, was elected president of the section, succeeding E. R. Gross of Mississippi Agricultural College.

James Arentson of Memphis will be vice-president and Charles E. Seitz of Blacksburg, Va., will be secretary and treasurer.

The papers presented included: "How to Improve Sanitary Conditions in the South," by H. R. Herndon, Portland Cement Association, Dallas, Texas; "Plantation Management," by. President-elect Morse; "Terracing as a Soil Saver," by H. B. Bliss, Tennessee Agricultural College; "Methods of Conducting Drainage Extension Work in the South," by S. H. McCrory, engineer in charge of rural engineering, Washington, D. C.; "Dynamiting," by P. H. Williams, Memphis; "Farm Machinery Situation in the South," by F. R. Jones, Knoxville, Tenn.; "The National Retail Hardware Association and the College Agricultural Engineers," by Herbert Sheets, secretary and treasurer of the Retail Hardware Association; "Agricultural Engineering Experimental Work," by F. D. Cotrell, Mississippi Agricultural and Mechanical College; "Agricultural Engineering Instruction," by Daniel Scoates, Texas Agricultural and Mechanical College; "Instructive Work in Agricultural Engineering," by E. R. Gross, Mississippi Agricultural and Mechanical College.

The closing afternoon of the meeting was devoted to inspection of the experimental work being carried on under the supervision of C. E. Ames, assistant director at the branch experiment station at Holly Springs, Miss. These experiments have to do with reclaiming and conserving land by the use of terraces in connection with certain special devices for preventing erosion.

School for Safety Supervisors

A series of addresses and instructions in safety principles and practices to be given to managers, engineers, superintendents, safety department employes and others interested by the Chicago Safety Council, organized by the Chicago Association of Commerce.

PURPOSE OF SCHOOL

The purpose of the school for safety supervisors is to encourage and stimulate interest in the important work of accident prevention on the part of the men and women employed in the various industries in Chicago and its environs; to make this city a safer and, therefore, a better place in which to work and live; to promote co-operation and the interchange of ideas, plans and methods, and to develop in this manner men who will become leaders in safety, who will teach *safety* by example and by precept and who will by this means perform for their fellow men and for the community in which we live a service of which they and this school shall be proud. It is hoped that the principles here outlined will become the creed of every individual who avails himself of this course.

Safety as an organized work is relatively new. Only the surface of this problem has been touched. We do know, however, that most casualties are preventable; many industries are substantially eliminating them. Safety is fundamentally a humanitarian work of conserving human life and limb. The work is built on that foundation; but, in addition, safety is good business. It has a tremendous economic value.

The School for Safety Supervisors affords an unique opportunity to secure invaluable instruction in safety with a minimum expenditure of time and effort. The address will be made by men who are nationally recognized as authorities in this work Their talks will be practical, readily understood and of inestimable value. An informal round-table discussion will follow each address. Members of the school will receive a printed synopsis of each address so that they may study and become familiar with the lessons and retain the material as a permanent record of the course.

1. Sept. 14.—Safety and the Manager: The Importance of His Support, and How to Get It. W. E. Worth, International Harvester Company.
2. Sept. 28.—Design and Construction of Safeguards. L. F. Tuells, Liberty Mutual Insurance Company.
3. Oct. 12.—Plant Conditions—Arrangement, Order, Lighting. C. W. Price, National Safety Council.
4. Oct. 26.—Reaching the Foreman —What He Can Do to Promote Safety. J. W. Woltz, Youngstown Sheet & Tube Co., Youngstown, Ohio.
5. Nov. 9.—Bulletin Boards. F. H. Elam, American Steel Foundries.
6. Nov. 23.—Workmen's Inspection Committees and Meetings. J. Claude Smith, Inland Steel Company.
7. Dec. 7.—Eye Protection and Safe Clothing. F. M. Rooseland, National Safety Council.
8. Dec. 21.—Electrical Hazards. Charles B. Scott, Bureau of Safety.
9. Jan. 4.—Fire Protection in Relation to Safety. S. J. Williams, National Safety Council.
10. Jan. 18.—Plant Sanitation. Dr. A. M. Harvey, Crane Company.
11. Feb. 1.—First Aid. Dr. W. A. Evans, Chicago Tribune.
12. Feb. 15.—The New Employee—Instruction in Safety, Physical Examination, Continuity of Employment. A. H. Young, International Harvester Company.
13. March 1.—Accident Records: How to Compile and Use Them. Dr. Frederick S. Crum, Assistant Statistician, Prudential Insurance Company, Newark, N. J.
14. March 15.—Qualifications of a Safety Engineer—His Duties and Opportunities. J. A. Oartel, Carnegie Steel Company, Pittsburgh, Pa.
15. March 29.—General Review and Experience Meeting — Class Graduation. President of the Chicago Safety Council.

Time—Alternate Tuesdays commencing September 14, 1920. Starting at 7:30 p. m. sharp and adjourning at 9:30 p. m.

Place—Central Building, Y. M. C. A., second floor, 19 South Lasalle street.

Mr. E. S. Nethercut on Statistics Committee Chicago Association of Commerce

It is with pleasure that we can announce the appointment of Mr. E. S. Nethercut, secretary of the Western Society of Engineers, on the Statistics Committee of the Chicago Association of Commerce. Mr. Nethercut is well adapted for work of this nature. The committee is an important one functioning under the Business Administration Division of the Safety Council.

Obituary

Hiero B. Herr

Past President Western Society of Engineers

Hiero B. Herr died Friday, Sept. 3, 1920, at Dillsburg, Pa.

This announcement will bring sorrow to the many active workers in this society who knew him and recognized his worth and ability. Mr. Herr joined the society as a member June 11, 1885. He was president for the year 1894.

As chairman of the committee which prepared the code of ethics of the Western Society of Engineers he rendered a conspicuous service. The high moral as well as professional standard recorded in the code of ethics clearly indicates the character of the man.

Because of failing health Mr. and Mrs. Herr moved from Chicago about a year ago to be with their daughter, Mrs. W. S. Russell, at whose home he died.

Boost Journal Advertisers

The Publication Committee is putting forth every effort to make the JOURNAL the most interesting technical magazine published. In this effort they desire your co-operation. Patronize advertizers in the JOURNAL and tell them you saw their ad in our publication. The JOURNAL offers an ideal advertising medium, but the only way advertisers will know it is for you to tell them you saw it. While we are on the subject of advertising, is there not some individual, firm or corporation that you know that should advertise in our publication? Tell us who they are; tell them so. Don't overlook your own office, though. There is certainly some way that you can make a small investment in advertising space in the JOURNAL pay good dividends.

Notices

The Cleveland (Ohio) Engineering Society at its meeting on August 10 voted to become a charter member of the Federated American Engineering Societies.

E. H. Fox, Secretary of Chicago Subsitary of the National Association of Professional Refrigerating Engineers, announces that that organization will hold a meeting in the Western Society of Engineers' Hall on Wednesday, October 13, 7:30 p. m.

On Page 422 of the September issue of Reclamation Record published by the Department of Interior, Washington, D. C., a very interesting article was written, "Engineering Library." A copy may be had by any one upon request from Reclamation Service, Dept. of Interior.

The Program Committee has completed arrangements for a large number of interesting meetings. Announcement of the program will be made monthly. In order to avoid missing these meetings each member can plan in advance from the data on the monthly announcement.

Keep the card on your desk.

Moving pictures at the beginning of each program. Promptly at 7 o'clock.

Money talks! Don't let it say goodbye! Buy W. S. S.

For Improvement of Transportation

For the improvement of transportation service the following definite goal has been set by the Advisory Committee of the Association of Railway Executives, of which Daniel Willard is Chairman:

1. An average daily minimum movement of freight cars of not less than 30 miles per day;
2. An average loading of 30 tons per car;
3. Reduction of bad order cars to a maximum of 4 per cent of total owned;
4. An early and substantial reduction in the number of locomotives now unfit for service;
5. More effective efforts to bring about the return of cars to the owner roads.

The Association of Railway Executives is publishing a bulletin "More Transportation." The first number is dated August 20, 1920, and is for the "information of officials of railroads and others to unify all forces in the effort to secure maximum service from existing transportation facilities."

Personal

General Harries, M. W. S. E., has been chosen Commander in Chief of the Military Order of the World War.

Louis I. Simon, member of the W. S. of E., has associated himself with Mr. Koenigsberg, conducting as architects and engineers. They are located at 8 South Dearborn street.

T. W. Ingemanson, Junior Member W. S. of E., is at present with the Iowa State Highway Commission, located at Charles City, Iowa. He has charge of the concrete road construction.

Mr. Karl Bannerman, M. E., Metropolitan Electric Company, Manchester, England, visited the meeting of the society September 13, 1920. Mr. Bannerman is visiting this country in the interests of his company.

Meetings W. S. E.

Monday, September 13, 1920. *Meeting No. 1090*

Major John C. H. Lee, Corps of Engineers, U. S. A., presented a very interesting paper on the St. Lawrence-Great Lakes Waterway, and covered in a very interesting way the engineering features of this important tide water connection for Chicago. Major Lee illustrated his address with numerous lantern slides showing the developments which have already been in successful operation and by means of maps indicated the problems of river control, canal and water power development incidental to this program. There were in attendance eighty-seven members and guests of the Society.

Wednesday, September 16, 1920. *Meeting No. 1091*

Mr. James A. Peabody, Signal Engineer, Chicago Northwestern Railway, Chicago, presented a carefully prepared paper on "The Relation of the Engineer to Railroad Transportation." Mr. Peabody is thoroughly informed with regard to the customary functions of the engineer, also the value of engineering analysis of transportation problems. An analysis from a cost standpoint of railroad operation, together with an analysis of the known methods of increasing transporation capacity, was urged. The ability of the engineer to properly analyze and valuate the elements entering into this problem was clearly demonstrated. The paper was discussed by Messrs. Felt, Howson and Shaver. There were present forty-five members and guests of the Society.

Monday, September 20, 1920. *Meeting No. 1092*

"Housing Development," with lessons from the experience of the United States Housing Corporation and numerous industrial housing enterprises, was presented at this meeting by Mr. L. K. Sherman, Vice-President of the E. T. Perkins Engineering Company, and former President of the United States Housing Corporation. Mr. Sherman analyzed the relation of the architect, town planter and engineer to housing and the effect of attractive design of both housing and grounds together with the engineering involved in utilities such as paving, sewers, water supply, and sanitation. All these elements are essential to proper housing. There was also presented a very careful analysis of the costs of the various types of housing which have been constructed and the relation between present day and pre-war costs.

The paper was discussed by Messrs. John V. Alvord, C. E. Paul and Paul Green. There were present sixty members and guests of the Society.

EDGAR S. NETHERCUT, *Sec'y.*

Engineers Corps and Construction Service

The latter has been placed under the command of Brig. General J. M. Carson who was zone supply officer and depot quartermaster at New York. Col. Edward Walton has been placed in charge of the Eastern District of the Construction Service with headquarters at Washington. The following appointments have been made in the Engineer Corps: Col. W. J. Barden in charge of Cincinnati Engineering District; Col. Spencer Crosby, in charge of the Southeastern Division and Jacksonville District; Col. Edward Schulz, in charge of Seattle Engineering District; Col. William V. Judson, in charge of Milwaukee Engineering District, Chicago Engineering District and the Northwestern Division; Col. Geo. F. Howell, in charge of the Charleston Engineering District and Southwestern Division; Colonel Merriweather L. Walker has been made commandant of the engineers' school at Camp Humphreys, Va.

There is still a lot of room for improvement in a world where people trade Liberty bonds for oil stocks.

DEVELOPMENT COMMITTEE

E. T. HOWSON, Chairman

At a meeting of the Development Committee held on August 19th the question of means of increasing the attendance at the meetings was considered at some length. It was felt that with the increased activity which the Program Committee is displaying the programs should be of such a character as to create increased interest among ouur members. The attention of the committee was therefore devoted to means of supplementing the work of the Program Committee.

As a result of its deliberations the committee desires to make the following recommendations for your consideration.

(1) That the use of moving pictures, preferably of an educational nature, be tried out regularly for a number of meetings, the pictures being introduced immediately at the opening of the meeting to stimulate early and prompt attendance.

(2) That more attention be given to making each announcement of the meeting individual in character and of an interest-creating type, presenting those features of interest concerning the speaker, his subject, and other details of the program which will make the average member want to attend.

(3) The preparation of bulletins for each meeting, to be placed regularly on the bulletin boards of large engineering offices, these bulletins to be removed immediately after the meeting and not allowed to become obsolete.

(4) Special effort should be made to print papers sufficiently in advance to enable them to be distributed to the members before the meeting, enabling the paper to be presented in abstract at the meeting and allowing more time for discussion.

Sears Roebuck Excursion

If you were not there you missed a very interesting afternoon, not mentioning the lunch. About 375 members and their guests were present. We were first taken into the dining room, where the inner man was well taken care of. From the dining room the members were divided into groups of twenty to twenty-five, and under special guides were shown through parts of the wonderful organization. As a fitting climax each one was presented with a souvenir booklet. Truly an enjoyable afternoon was spent by every member of the party.

NOON-DAY LUNCHEON COMMITTEE

J. H. LIBERTON, Chairman

NEW SERIES OF NOON-DAY LUNCHEON MEETINGS START IN OCTOBER.

Excellent attendance at the noon-day luncheon meetings addressed by Samuel Insull and David R. Forgan last spring indicated that this new feature of Society activities filled a long-felt want. For that reason the Noon-Day Luncheon Committee is planning a series of monthly noon-day luncheon meetings to commence in October. The first of the new series is scheduled for October 8 and will be held in the Cameo room, Hotel Morrison.

Replies received from well-known and interesting speakers indicate that the committee will be able to announce an excellent list of talks.

As the noon-day luncheon meetings are planned to give members of the Western Society of Engineers an opportunity of listening to talks on up-to-the-minute subjects, it is expected that the coming series will attract even larger crowds than attended the very successful meetings of last spring.

Service at the luncheon meetings will start at 12:15 p. m., with speaking at 1 p. m. Meetings will close promptly at 1:30 p. m.

The regular noon-day luncheon meetings will be held the first Friday after the first Wednesday of each month and will be $1 per plate. The dates will be as follows: Oct. 8, Nov. 5, Dec. 3, Jan. 7, 1921; Feb. 4, March 4, April 8, May 6 and June 3, 1921. J. H. Libberton is chairman of the Noon-Day Luncheon Committee.

Prizes for Technical Papers

The Western Society of Engineers offers two prizes for technical papers presented before it: The Chanute Medal and the Hunt Award.

In 1902 Mr. Octave Chanute, retiring president, provided a fund to be administered by this society. The award from this fund is in the form of a bronze medal and a certificate. It is given to the author of the best paper presented during each year. The author must be a member of the Western Society. Papers are classified under general engineering, civil engineering, mechanical and electrical engineering.

The value of a paper primarily should be estimated by the amount and general usefulness of the engineering or related scientific information it contains. Consideration should also be given to clearness, conciseness and originality.

The Robert W. Hunt Award was made possible by the generous gift of Mr. Hunt in December of last year. The prize is the proceeds of a $5,000 5 per cent bond, and is for the best paper pertaining to the manufacture of iron or steel products or their subsequent fabrication. The paper shall be contributued during the preceding calendar year by a member of the Western Society, said member not being more than 35 years of age. The award is made annually during each calendar year.

A committee is now preparing a set of rules governing the award and these will be published in the JOURNAL as soon as completed.

The attention of our younger members is espeically directed to this award and already we have been advised that papers are being prepared for presentation. In order to fully carry out the spirit of the donation it is hoped that the competition for the Robert W. Hunt Award will result in papers of importance.

Newspaper Comments

In the last issue of the JOURNAL was published a report by the Public Affairs Committee—"State Regulation of Public Utilities vs. Home Rule." The *Post*, *News* and *Tribune* have published the same article in various forms. The *Tribune* used it as a subject for an editorial, as well as being mentioned by several magazines such as the *Electric Railway Journal*, the *Chicago Commerce*, and several others.

The Western Society of Engineers is fast becoming known to the general public, as it should justly be. The war made people know that engineers were equal to the occasion and consequently the newspaper comments on this recent report will have considerable influence on public opinion.

It is unquestionably the duty of the W. S. E. to express its views on any subject where their special qualifications are the accepted authority. If you have failed to read this report dig out your September 5 issue of the JOURNAL and turn to page 13. It be well worth your trouble.

Addresses Wanted

The following list of members are missing some very interesting announcements, not mentioning the JOURNAL, because they have failed to notify the society of any change of addresses.

Anyone knowing the present addresses of the following members will do us a favor by sending them in:

Major Harry M. Trippe, c|o 308 U. S. Engineers, Camp Sherman, Ohio.

Victor E. Marx, 38 Lafayette avenue, New York City.

William A. Field, 1000 North Market street, Canton, Ohio.

L. B. Fugitt, 302 Piedmont Building, Charlotte, N. C.

Fred A. Locke, 2017 Maple avenue, Evanston, Ill.

William S. Morton, 865 Pacific Building, San Francisco, Cal.

Albert S. Shiavitz, c|o H. Muller Mfg. Co., Ltd., Sarnia, Canada.

George Dunderdale, 1347 Peoples Gas Building, Chicago, Ill.

J. M. Pruden, 911 City Hall Square Building, Chicago, Ill.

Floyd E. Evans, 5252 Calumet avenue, Chicago, Ill.

H. I. Eagen, 1101, 189 West Madison street, Chicago, Ill.

E. R. Swansen, 1705 Harris Trust Building, Chicago, Ill.

James L. Anning, c|o Rice Hotel, Houston, Texas.

September Meeting of the Board of Direction

At the September meeting of the Board of Direction the following action was taken:

APPLICATION FOR MEMBERSHIP

Alfred McMurdie	(Transfer from Student)	Kalamazoo, Mich.
Julian Frank	(Transfer from Student)	Chicago, Ill.
Paul F. Olsen		Chicago, Ill.
Joseph C. Bernd		Chicago, Ill.

ELECTION TO MEMBERSHIP

H. L. Woolhiser	Winnetka, Ill	Member
Tyler G. Price	Chicago, Ill	Junior Member
Horace L. Howell	New York, N. Y	Member
Earl P. Shnable	Wilmette, Ill	Junior Member
J. D. Hurley	Chicago, Ill	Member
Milton D. Cole	Chicago, Ill	Junior Member
L. D. Cornish	Chicago, Ill	Member
F. A. Nelson	Newark, N. J	Associate Member
Harry M. Nacey	Chicago, Ill	Member
James C. Williams	Chicago, Ill	Associate Member
L. M. Hansen	Chicago, Ill	Associate Member
John Gravely	Chicago, Ill	Member
D. E. Postle	Chicago, Ill	Member

RESIGNATIONS ACCEPTED

A. J. A. Anderson	Junior Member
J. L. Hinch	Associate Member

PUBLICATION OF THE JOURNAL

The increased cost of printing and paper has become so critical that it was decided to publish the JOURNAL for the balance of the year as a monthly publication in place of bi-monthly.

DATE OF REGULAR MEETING OF BOARD OF DIRECTION

This was changed from the second Monday of each month to the first Monday after the fifteenth of each month.

September 4, 1920.

Mr. W. S. Russell,
Dillsburg, Pa.

My Dear Mr. Russell:

It is with a feeling of great sorrow that I received your telegram this morning announcing the death of Mr. Herr. On behalf of the Western Society of Engineers I tender to yourself, Mrs. Herr and Mrs. Russell our sincere sympathy in your bereavement.

A loss will be felt by a very large circle of friends among the engineering profession. Mr. Herr has rendered many conspicuous services to the profession and has been a leader and an inspiration to us all. His very high character and splendid friendliness has been an inspiration to me and all those who came in contact with him in connection with our Society. Mr. Herr joined the Society on June 16, 1885, and was president in 1894. Among the conspicuous services which he rendered was as chairman of the committee to compile a code of ethics, and throughout this code there is evidence of his thoughtful consideration of all those elements of character which are essential to success.

On behalf of the Society, I am,

Very truly yours,

EDGAR S. NETHERCUT, *Secretary*.

Uniform Law for Registering Engineers, Architects and Surveyors Recommended by Special Committee Engineering Council

Editor's Note. In Mr. Condron's paper on the State Registration of Engineers, reference is made to the proposed law as herewith presented. Mr. Condron's paper can be found on page 544 of this issue.

Title.—An Act to regulate the practice of professional engineering, architecture and land surveying.

[Note: (*a*) In certain states further amplification of title may be required by law; (*b*) The brief terms "professional engineering," "architecture" and "land surveying" give simpler and clearer understanding of the activities affected by this act than any definition—Such definitions as have been devised have proven academic, difficult of proper inclusion and exclusion, confusing, laborious and frequently of great length; (*c*) Architectural work is basicly engineering, with an aesthetic element added. The architect is of nearer kin to the structural engineer than is the electrical engineer. The model architectural definition of a building is that of an engineering structure. Architects form part of the membership of the American Society of Civil Engineers. Laws for the reigstration of architects and engineers must be either in parallel or in common. Assuming the best interests of each to lie in co-operation, and having in mind economical administration of a law, both are included in this act. Surveying is a function of engineering, but land surveying deals with land measurements involving property rights.]

The People of the State of .... enact:

Section 1.—In order to safeguard life, health and property, any person practicing or offering to practice professional engineering, architecture or land surveying in this state shall hereafter be required to submit evidence that he or she is qualified so to practice, and shall be registered as hereinafter provided, and from and after............. months after this Act becomes effective, it shall be unlawful for any person to practice or to offer to practice professional engineering, architecture or land surveying in this state, unless such person has been duly registered under the provisions of this Act.

[Note: (*d*), The constitutionality of this law is based on its promoting the public welfare by safeguarding life, health and property.]

Section 2.—Nothing in this Act shall be construed as requiring registration for the purpose of practicing professional engineering, architecture or land surveying by an individual, firm or corporation on property owned or leased by said individual, firm or corporation unless the same involves the public safety or health.

[Note: (*e*), Obviously no modern agriculturist should be prohibited from laying out and building the ditches or roads on his farm, or planning and building his own barn.]

Appointment of the Board

Section 3.—To carry out the provisions of this Act there is hereby created a State Board of Registration for professional engineers, architects and land surveyors, hereinafter called the "Board," consisting of seven members, who shall be appointed by the Governor within sixty days after this Act becomes effective. At least three members shall be professional engineers, and at least three members shall be architects. Not more than one member of said Board shall be from the same branch of the profession of engineering. The members of the first Board shall be appointed to serve for the following terms: Two members for one year; two members for two years; two members for three years, and one member for four years; said terms ending on the first day of .... of the succeeding years. On the expiration of each of said terms the term of office of each newly appointed or reappointed member of the Board shall be for a period of four years and shall terminate on the first day of .... Each member shall hold over after the expiration of his term until the successor shall be duly appointed and qualified. The Governor may remove any member of the

Board for misconduct, incompetency or neglect of duty. Vacancies in the membership of the Board, however created, shall be filled by appointment by the Governor for the unexpired term.

QUALIFICATIONS AND EXPENSES

Section 4.—Each member of the Board shall be a citizen of the United States and a resident of this State at the time of his appointment. He shall have been engaged in the practice of his profession for at least ten years and shall have been in responsible charge of work for at least five years. He shall be a member in good standing of a recognized society of professional engineers or architects, and except as provided in Section 5, shall be a registered professional engineer or a registered architect. Each member of the Board shall receive .... dollars ($......) per day for attending sessions of the Board or of its committees, and for the time spent in necessary travel, and, in addition, shall be reimbursed for all necessary traveling, incidental and clerical expenses incurred in carrying out the provisions of this Act.

[Note: (*f*), The per diem allowance of each member of the Board is not expected to be adequate compensation. High grade professional men are expected to serve as a matter of good citizenship.]

CERTIFICATES, PRIVILEGES AND POWERS OF THE BOARD

Section 5.—Each member of the Board shall receive a certificate of appointment from the Governor, and before beginning his term of office he shall file with the Secretary of State the constitutional oath of office. Each member of the Board first created shall receive a certificate of registration under this Act from the Governor of this State. The Board or any committee thereof shall be entitled to the services of the Attorney General, in connection with the affairs of the Board, and the Board shall have power to compel the attendance of witnesses, may administer oaths and may take testimony and proofs concerning all matters within its jurisdiction. The Board shall adopt and have an official seal which shall be affixed to all certificates of registration granted; and shall make all by-laws and rules not inconsistent with law needed in performing its duty. Suitable office quarters shall be provided by the State for the use of the Board in the City of ......

ORGANIZATION AND MEETINGS OF THE BOARD

Section 6.—The Board shall hold a meeting within thirty days after its members are first appointed, and thereafter shall hold at least two regular meetings each year. Special meetings shall be held at such times as the by-laws of the Board may provide. Notice of all meetings shall be given in such manner as the by-laws may provide. The Board shall elect annually from its members a chairman, a vice-chairman and a secretary. A quorum of the Board shall consist of not less than two engineer and two architect members.

RECEIPTS AND DISBURSEMENTS

Section 7.—The secretary of the Board shall receive and account for all moneys derived from the operation of this Act and shall pay them to the State Treasurer, who shall keep such moneys in a separate fund to be known as the "Fund of the Board of Registration for Professional Engineers, Archiects and Land Surveyors," which fund shall be continued from year to year and shall be drawn against only for the purpose of this Act as herein provided. All expenses certified by the Board as properly and necessarily incurred in the discharge of its duties, including authorized compensations, shall be paid out of said fund on the warrant of the auditor of the State issued on requisitions signed by the chairman and the secretary of the Board; provided, however, that at no time after this Act has been in effect for one year shall the total of warrants issued exceed the total amount of funds accumulated under this Act. The secretary of the Board shall give a surety bond satisfactory to the State Treasurer conditioned upon the faithful performance of his duties. The premium on said bond shall be regarded as a proper and necessary expense of the Board.

[Note: (*g*), The administration of the law is made ultimately self-supporting. The legislaure is not expected to appropriate money to accomplish the results contemplated.]

Records and Reports

Section 8.—The Board shall keep a record of its proceedings and a register of all applicants for registration showing for each, the date of application, name, age, educational and other qualifications, place of business and place of residence, whether or not an examination was required and whether the applicant was rejected, or a certificate of registration granted, and the date of such action. The books and register of the Board shall be prima facie evidence of all matters recorded therein. A roster showing the names and places of business and of residence of all registered professional engineers, architects and land surveyors shall be prepared by the secretary of the Board during the month of .... of each year; such roster shall be printed by the State out of the fund of the Board as provided in Section 7, and a copy mailed to and placed on file by the clerk of each incorporated city, town and county in the State. On or before the .... day of .... of each year the Board shall submit to the Governor a report of its transactions for the preceding year, and shall file with the Secretary of State a copy of such report, together with a complete statement of the receipts and expenditures of the Board, attested by the affidavits of the chairman and the secretary, and a copy of the said roster of registered professional engineers, registered architects and registered land surveyors.

Applications for and Issuance of Certificates

Section 9.—The Board shall, on application therefor, on prescribed form and the payment of a fee of .... dollars ($........), issue a certificate of registration:

[Note: (*h*), The application required should include a complete statement of an applicant's education and a detailed summary of his technical work. The statements made should be under oath and should be supported by the recommendations of not less than two professional engineers, architects or land surveyors as vouchers.]

1.—To any person who submits evidence satisfactory to the Board that he or she is fully qualified to practice professional engineering, architecture or land surveying; or

2.—To any person who holds a like unexpired certificate of registration issued to him or her by proper authority in any state or territory of the United States, or in any province of Canada, in which the requirements for the registration of professional engineers, architects or land surveyors are of a standard satisfactory to thhe Board;

Provided, however, that no person shall be eligible for registration who is under twenty-five years of age, who is not a citizen of the United States or Canada, or who has not made declaration of his or her intention to become a citizen of the United States, who does not speak and write the English language, who is not of good character and repute, and who has not been actively engaged for six or more years in the practice of professional engineering, architecture or land surveying of character satisfactory to the Board. However, each year of teaching, or of study satisfactorily completed, of engineering or architecture in a school of engineering or architecture of standing satisfactory to the Board, shall be considered as equivalent to one year of such active practice.

[Note: (*i*), The functions of the Board are largely administrative and judicial. The burden of presenting evidence of qualification is placed upon the applicant. The Board may in doubtful cases give technical examinations; but the clear intent is to utilize other state agencies, as, for instance, the engineering or architectural schools, to submit as evidence the results of examinations, with recommendations as to competency.]

Unless disqualifying evidence be before the Board, the following facts established in the application shall be regarded as prima facie "evidence, satisfactory to the Board," that the applicant is fully qualified to practice professional engineering, architecture or land surveying:

[Note: (*j*). When the law goes into effect a large percentage of practicing engineers, architects and land surveyors will be registered to preserve the status quo. Long-continued practice, graduation from a technical school of approved standing with subsequent years of practice, or membership in high-grade technical societies, in the absence of disqualifying facts, is accepted as prima facie evidence of qualification, as stated below.]

(*a*) Ten or more years of active engagement in professional engineering, architectural or land surveying work;

(*b*) Graduation, after a course of not less than four years, in engineering or architecture, from a school or college approved by the Board as of satisfactory standing, and an additional four years of active engagements in professional engineering, architecture or land surveying work;

(*c*) Full membership in the American Institute of Architects, American Society of Civil Engineers, American Institute of Chemical Engineers, American Institute of Electrical Engineers, American Society of Mechanical Engineers, American Institute of Mining and Metallurgical Engineers, American Society of Naval Architects and Marine Engineers, or such other national or state engineering or architectural societies as may be approved by the Board, the requirements for full membership of which are not lower than the requirements for full membership in the professional societies or institutes named above.

Applicants for registration, in cases where the evidence originally presented in the application does not appear to the Board conclusive or warranting the issuance of a certificate, may present further evidence which may include the results of a required examination, for the consideration of the Board.

[Note: (*k*). The standard of qualification is set high for two reasons: The public welfare will be better promoted by maturer competency; and the prestige attaching to the term "Registered" will be more significant for the professional men themselves. In requiring the younger, less experienced men to serve somewhat longer as assistants or understudies to older men, no hardship is imposed which will not be compensated by the fuller return in recognition when registration is achieved.]

In determining the qualifications of applicants for registration as architects, a majority vote of the architect members of the Board only shall be required; and in determining the qualifications of applicants for registration as professional engineers or land surveyors, a majority vote of the engineer members of the Board only, shall be required.

[Note: (*l*), The acceptance for registration of engineers by the engineers on the Board, and of architects by the architects on the Board, places the judicial finding of fitness or unfitness in the hands of those best qualified to judge. In administrative matters and in the revocation of certificates the Board acts as a unit.]

In case the Board denies the issuance of a certificate to an applicant, the registration fee deposited shall be returned by the Board to the applicant.

Certificates of registration shall expire on the last day of the month of .... following their issue or renewal and shall become invalid on that date unless renewed. It shall be the duty of the secretary of the Board to notify by mail every person registered hereunder of the date of the expiration of his certificate and the amount of the fee required for its renewal for one year; such notice shall be mailed at least one month in advance of the date of the expiration of said certificate. Renewal may be effected at any time during the month of .... by the payment of a fee of .... dollars to the secretary of the Board. The failure on the part of any registrant to renew his certificate annually in the month of .... as required above shall not deprive such person of the right of renewal thereafter, but the fee to be paid for the renewal of a certificate after the month of .... shall be increased 10 per cent for each month or a fraction of a month that payment for renewal is delayed; provided, however, that the maximum fee for a delayed renewal shall not exceed twice the normal fee.

[Note: (*m*), The amount of the fee to be paid by a registrant must be established by each state in the light of the number of fees to be expected, and the cost of administration.]

REVOCATION AND REISSUE OF CERTIFICATES

Section 10.—The Board shall have the power to revoke the certificate of registration of any professional engineer, architect or land surveyor registered hereunder who is found guilty of any fraud or deceit in obtaining a cetificate of registration or of gross negligence, incompetency or misconduct in the practice of professional engineering, architecture or land surveying. Any person may prefer charges of such fraud, deceit, negligence, incompetency or misconduct against any professional engineer, architect or land surveyor registered hereunder; such charges shall be in writing and sworn to by the complainant and submitted to the Board. Such charges, unless dismissed without hearing by the Board as unfounded or trivial, shall be heard and determined by the Board within three months after the date on which they are preferred. A time and place for such hearing shall be fixed by the Board. A copy of the charges, together with a notice of the time and place of hearing shall be legally served on the accused at least thirty days before the date fixed for the hearing, and in the event that such service cannot be effected thirty days before such hearing, then the date of hearing and determination shall be postponed as may be necessary to permit the carrying out of this condition. At said hearing the accused shall have the right to appear personally and by counsel and to cross-examine witnesses against him or her and to produce evidence and witnesses in his or her defense. If after said hearing five or more members of the Board vote in favor of finding the accused guilty of any fraud or deceit in obtaining a certificate or of gross negligence, incompetency or misconduct in the practice of professional engineering, architecture or land surveying, the Board shall revoke the certificate of registration of the accused.

The Board may reissue a certificate of registration to any person whose certificate has been revoked, provided five or more members of the Board vote in favor of such reissue for reasons the Board may deem sufficient.

The Board shall immediately notify the Secretary of State and the clerk of each incorporated city, town and county in the state of its findings in the case of the revocation of a certificate of registration or of its reissuance of a revoked certificate of registration.

[Note: (*n*), Revocation is recognized as a serious procedure in its effect on professional reputation, and the right of hearing and contest is recognized and provided for.]

A new certificate of registration to replace any certificate lost, destroyed or mutilated may be issued subject to the rules and regulations of the Board. A charge of one dollar shall be made for such reissue.

SIGNIFICANCE OF CERTIFICATE—SEALS

Section 11.—The issuance of a certificate of registration by this Board shall be evidence that the person named therein is entitled to all the rights and privileges of a registered professional engineer, registered architect or registered land surveyor while the said certificate remains unrevoked or unexpired.

Each registrant hereunder shall upon registration obtain a seal of the design authorized by the Board, bearing the registrant's name and the legend, "Registered Professional Engineer", or "Registered Architect", or "Registered Land Surveyor." Plans, specifications, plats and reports issued by a registrant may be stamped with said seal during the life of registrant's certificate, but it shall be unlawful for anyone to stamp or seal any documents with said seal after the certificate of the registrant named thereon has expired or has been revoked unless said certificate has been renewed or reissued.

UNLAWFUL ACTS AND PENALTIES

Section 12.—Any person who after this Act has been in effect .... months is not legally authorized to practice professional engineering, architecture or land surveying in this state according to the provisions of this Act and shall so practice, or offer so to practice in this state, except as provided in Section 13 of this Act, and any person presenting or attempting to file as his own the certificate of registration of another, or who shall give false or forged evidence of any kind to the Board, or to any member thereof, in obtaining a certificate of registration, or who shall falsely impersonate any other practitioner, of like or different name, or who shall use or attempt to use an expired or revoked certificate of registration, shall be deemed guilty of a misdemeanor and shall for each such offense of which he is convicted be punished by a fine of not less than one hundred dollars ($100) nor more than five hundred dollars ($500), or by imprisonment for three months, or by both fine and imprisonment. However, nothing in this Act shall be construed as excluding any registered architect from the practice of professional engineering or as excluding any registered professional engineer from the practice of architecture.

[Note: (*o*), This Act only gives prestige to the titles "Registered Professional Engineer," "Registered Architect" or "Registered Land Surveyor," but it prohibits the practice as principals of all persons not registered; (*p*) By reason of overlapping of the fields of engineering and architecture, a clear line of demarcation cannot be made between these two professions; (*q*) As this Act does not prohibit a chemical engineer from building a steel arch bridge, it appears inconsistent to prohibit an architect from building such a bridge, or a structural engineer from building a church. Ethical considerations and professional opinion must confine the scope of each person's practice to the fields in which he is a master.]

EXEMPTIONS

Section 13.—The following shall be exempted from the provisions of this Act:

1. Offering to practice in this state as a professional engineer, architect or land surveyor, by any person not a resident of and having no established place of business in this state.

[Note: (*r*), A professional card in a journal of national circulation is an "offer to practice" in any state in the Union. It would be manifestly unfair to compel a professional man to register in every state in which he may in this way, or by letter or otherwise, express his readiness to accept an engagement.]

2. Practice as a professional engineer, architect or land surveyor in this state by any person not a resident in this state and having no established place of business in this state, when this practice does not aggregate more than fifteen days in any calendar year; provided, that said person is legally qualified for such professional service in his own state or country.

[Note: (*s*), It is a distinct advantage to the people of any state to be able to call in for consultation a specialist from any other state. Such practice may be brief and often of an emergency nature.]

3. Practice as a professional engineer, architect or land surveyor in this state by any person not a resident of and having no established place of business in this state, or any person resident in this state, but whose arrival in the state is recent; provided, however, such a person shall have filed an application for registration as a professional engineer, an architect or a land surveyor and shall have paid the fee provided for in Section 9 of this Act. Such exemption shall continue for only such reasonable time as the Board requires in which to consider and grant or deny the said application for registration.

4. Engaging in professional engineering, architecture or land surveying as an employe of a registered professional engineer, a registered architect or a registered land surveyor, or as an employe of a professional engineer, architect or land surveyor, authorized by paragraphs 2 and 3 of this section, provided that said practice may not include responsible charge of design or supervision.

5. Practice of professional engineering, architecture and land surveying solely as an officer or as an employe of the United States.

6. Practice of professional engineering, architecture or land surveying solely as an employe of this state or any political subdivision thereof, at the time this Act becomes effective and thereafter only until the expiration of the then existing term of office of such employe.

CORPORATIONS OR PARTNERSHIPS

Section 14.—A corporation or partnership may engage in the practice of professional engineering, architecture or land surveying in this state, provided the person or persons connected with such corporation or partnership in charge of the designing or supervision which constitutes such practice is or are registered as herein required of professional engineers, architects and land surveyors. The same exemptions shall apply to corporations and partnerships as apply to individuals under this Act.

PUBLIC WORK

Section 15.—One year after this Act goes into effect, neither the state nor any county, township, city, town or village nor other political subdivision in the state, shall engage in the construction or maintenance of any public work involving professional engineering or architecture for which the plans, specifications and estimates have not been made by, and the construction and maintenance supervised by, a registered professional engineer, or a registered architect; provided, that nothing in this section shall be held to apply to such public work wherein the contemplated expenditure for the completed project does not exceed two thousand dollars ($2,000).

LAND SURVEYING

Section 16.—Land surveying as covered by this Act refers only to surveys for the determination of areas or for the establishment or re-establishment of land boundaries and the subdivision and platting of land. Nothing in this Act shall be construed as prohibiting registered professional engineers or registered architects from making land surveys where such surveys are essential to engineering or architectural projects.

REPEAL OF CONFLICTING LEGISLATION

Section 17.—All laws or parts of laws in conflict with the provisions of this Act are hereby repealed.

COMMITTEE ON LICENSING OF ENGINEERS

John W. Alvord,[1] Chicago, Ill.
Bion J. Arnold,[1,4] Chicago, Ill.
John H. Dunlap,[1] Iowa City, Iowa.
A. Lincoln Fellows,[1] Denver, Colo.
Farley Gannett,[1] Harrisburg, Pa.
Arthur M. Greene, Jr.,[3] Troy, N. Y.
James H. Herron,[2,3,5] Cleveland, O.
John Klorer,* New Orleans, La.
Caleb M. Saville,[1] Hartford, Conn.
A. M. Schoen,[4] Atlanta, Ga.
Francis C. Shenehon,[1] Minneapolis, Minn.
Amos Slater,[2] Seattle, Wash.
Christopher H. Snyder,[1] San Francisco, Cal.
John W. Woermann,[1] St. Louis, Mo.

Theodore L. Condron,[1,5], Chairman, Chicago, Ill.

NOTE.—Society memberships of the members of the committee are indicated by numbers, as follows:

[1] American Society of Civil Engineers.

[2] American Institute of Mining and Metallurgical Engineers.

[3] American Society of Mechanical Engineers.

[4] American Institute of Electrical Engineers.

[5] American Society for Testing Materials.

The member societies of Engineering Council.

* President, Louisiana Engineering Society.

EMPLOYMENT SERVICE

Do you need assistants?

Do you want a position?

Do you feel that you have men in your employ that are needed more in some other position?

Do you wish a change or advancement? The service we render is to bring men together for their mutual benefit. In order to do this, we offer free of charge, this Employment Service. Will you use it?

Positions Available

A-70: WANTED—STRUCTURAL designer with mech. experience; familiar with coal and ore handling machinery; salary $250 per month.

A-71: GRADUATES WHO DESIRE to connect with a large manufacturer of miscellaneous electrical household appliances; located in Chicago, Ill. We need four men from 1919 or 1920 graduate class who are ready to spend one or two years learning the details of engineering, sales, production or manufacturing department.

A-72: WANTED — MECH. ENGINEER to take entire charge of mech. department of large industrial engineering firm in Chicago; thorough knowledge of power plant, heating, plumbing, ship equipment, etc.; salary, $5,000 to $10,000.

A-73: WANTED — ENGINEER with experience on the design of machinery and plant layouts, to take charge of the Engr. department of medium sized manufacturing plant near Chicago; location ideal.

A-74: WANTED—MEN ABLE to handle inspection work on building construction and also to be available for building and mechanical drafting.

A-75: INSTRUCTORS IN VARIOUS departments of well known state university: vacancies in architectural, civil engr., electrical engr., mech. engr., theoretical and applied mechanics, physics and railway mech. engr. departments; salaries, $1600 to $1800 for 10 months, depending upon qualifications of candidate.

A-76: APPLICATIONS WILL be received for first-class building superintendents for project at Memphis, Tenn. Must be young men, thoroughly competent and accustomed to reinforced concrete buildings; be able to lay off work; be up-to-date in form construction and capable to take entire charge of a building throughout.

A-77: MECHANICAL ENGINEERS and draftsmen wanted for designing and detailing conveying machinery both in Chicago and Louisville.

A-78: WANTED—A LIVE, ALERT young man with reasonably thorough technical training in addition to practical experience for taking off quantities of different materials, occasionally making a layout and such general work as this might entail. A good opportunity for advancement is offered. Work at Memphis, Tenn.

A-80: CHICAGO CONCERN REQUIRES services of an experienced man on chemical plant construction and operation. This position involves building and starting a potash plant in So. Calif. Nature of work requires a man with at least 10 years' actual experience and salary will be paid in accordance with ability.

A-81: RAILROAD COMPANY

Positions Available—Continued

wants draftsman with knowledge of structural design and track.

A-82: RAILROAD CO. WANTS young engineering graduate to travel out of Chicago. Expenses allowed when on road, away from city.

A-83: RAILROAD CO. WANTS 4 engineers on valuation work familiar with structures and foundations.

A-84: INDUSTRIAL CONCERN wants engineer to sell service of their company. Experienced as contract agent preferred.

A-85: FOUR A-1 MECH. DRAFTSmen, familiar with piping of shops and roundhouses. Good position for temporary work.

A-86: WANTED—DRAFTSMEN familiar with freight car construction. Write fully experience and salary expected. General American Tank Car Corp., East Chicago, Ind.

A-87: WANTED—A DEPENDable and experienced structural steel estimater, an Illinois graduate, who is looking for a better job.

A-88: OPENING FOR A 1919 graduate having spent the intervening time in the design and detailing of reinforced concrete structures, with a view toward eventually entering our sales organization.

A-89: WANTED—FIRST-CLASS brick paving inspector for temporary work in Iowa. May lead to permanent location. Salary depending on experience.

Positions Wanted

B-700: MECH. ENGINEER specializing in machinery design, factory maintenance, extension, investigations and reports; available for such work on part time basis.

B-701: GRADUATE MECH. ENgineer, best references, open for power plant, testing and electrical engineering; technical writing or sales engr. work.

B-702: A-1 STRUCTURAL ENgineer and designer open for position in Philippine Islands or other foreign work; married; will consider two-year contract with expense for moving.

B-704: ENGINEER NOW EMployed; having experience: railway location and foundation work, Ry. construction, fixed and movable bridge design and construction; major with Canadian railway troops overseas; open for position where he can make use of his experience as executive and handling men; salary, $5,000; best references.

B-705: FIRST CLASS DRAFTSman desires work on construction details for private parties.

B-707: DESIGNER ON CONcrete and industrial buildings and estimator who can take care of office work and who is familiar with sub-contracts in above work, desires outside work; eight years experience; best references.

B-709: GRADUATE C. E., Northwestern University has had experience in general construction work, road construction and was asst. engr. of large city; desires position as supt. of construction; designer, structural steel or reinforced concrete, or as estimator.

B-710: MECHANICAL ENGIneer, age 35, technical education, thorough knowledge of the designing of power-plants, heating, ventilating, plumbing and fire-protection; can take entire charge of mechanical department of an architectural or engineering firm, including the making of plans, specifications, estimates, reports and the superintending and testing of installations; best references.

B-711: GRADUATE U. S. A. TOPographical School F. A. R. D. Thorough training in topographical work, railroad map and municipal drafting, seeks position along above lines.

B-712: CHICAGO LICENSED ENgineer. Broad experience in engine construction, mining machinery, motive power and equipment, hydraulic power and equipment. Best of references.

B-715: PROFESSOR ELEMENTARY mathematics wants position teaching elementary math., plane surveying or elementary physics. Night classes only.

B-716: GRAD. M. E. ARMOUR Ins., experienced designer of machinery, plant layout, etc. Production engineer of plant with machine shop, steel furniture shop, paint, electrical surgical inst. depts. wants position as (1) production engr., efficiency engr. or asst. supt.

B-717: RELIABLE YOUNG MAN open to position as rodman, instrumentman or chainman.

B-718: CAPABLE C. E. GRADUATE desires to make connection with commercial engineering concern where his experience will be beneficial. Best of references.

B-719: THOROUGHLY COMPETENT engineer open for position as genl. supt., shop mgr., mfg. machy. along following lines: Steam, gas, steel and iron, marine turbines, reciprocating, ice refrigeration, valves and fittings, heavy and light.

B-720: GRADUATE C. E., 18 years' exp. leading bridge and railroad companies wants position with bridge work in office or field.

B-721: GRAD. U. OF WIS. 1910 elec. eng., exp. testing, power maintenance departments wishes position with industrial plant as (1) power and maintenance, elec. (2) asst. to supt. power or (3) elec. engr.

B-723: ENGINEER ON HARBOR structures, foundations, steel and concrete structures of all kinds, familiar with design and details of construction of buildings and other structures wants position as designing engineer, squad boss, chief draftsman, estimator or supervising engr., preferably in contractor's office.

B-724: ENGINEER WITH EXPERIENCE in power plant operation and design, industrial plant design and conveying machinery. Open to position in similar work.

B-725: TECH. H. S. GRADUATE. Desires apprenticeship in civil or mech. engrg.

B-726: TECH. H. S. GRADUATE. Open to work along civil or mech. engrg. lines.

B-727: ENGR. HAVING EXPERIENCE as chief draftsman, mech. engr. and shop supt. of large mfg. concern desires position as (1) mech. engr., (2) shop supt. or (3) designer of machinery and power plants.

B-728: MAN HAVING STRUCTURAL engineering experience desires position along structural lines.

B-729: YOUNG MAN DESIRES temporary position as surveyor or other civil engineering work where his experience could be utilized.

B-730: MECH. ENGR. HAVING manufacturing experience in executive positions wants position as (1) sales engineer, (2) factory superintendent or (3) production engineer.

B-731: A-1 ENGINEER FAMILIAR with theory of deflection, continuous girders, swing bridges, arches, suspension bridges and secondary stresses. Also special problems in intermediate structures with the slope deflection method. Desires to become associated with responsible firm.

B-732: TECH. GRADUATE, three years' experience, wants position as structural draftsman.

B-733: POSITION WANTED AS bridge engr., mech. engr. or construction engr. by man of broad experience. Best references.

B-737: POSITION WANTED, EXECUTIVE. Former positions as draftsman, engineer, mechanical and construction supt. Eighteen years' experience. Steel, chemical and oil refining plants.

B-743: CIVIL ENGINEER, AGE 36, married, graduate of Stanford

Positions Wanted—Continued

University, twelve years' experience, ten years' active charge of hydraulic, railroad, wharf and concrete bridge work on Hawaiian Islands, as chief engineer and field engineer; have had full charge of projects from the preliminary surveys to completion; will consider a position as chief engineer or field engineer along the above lines; salary, $4,800. Best references.

B-745: GRAD. C. E. ARMOUR Inst. with seven years' exp. in R. R. and modern factory construction, desires position as supt. of const., const. engr. or resident engr.

B-747: MECH. DRAFTSMAN with experience in machine and tool design. Has had two years' practical shop work and four years' mech. drawing.

B-748: MECH. ENGR. WITH knowledge of power plant drawing, tool designing and sales experience desires position in (1) sales engineering; (2) production work, or (3) power plant, heating and vent. design.

B-749: SITUATION WANTED as steel metallographist, steel chemist or chemical engineer grad. U. of Ill., 1920. B. S., who has had practical laboratory experience during summer.

B-750: CAR DRAFTSMAN DEsires position with railway or railway supply company, experienced on pattern shop and foundry work.

B-751: MECH. ENG., 12 YEARS' experience with public utility company, broad business training as assistant to chief executive; married, wishes to get into a field where salary is proportional to responsibility.

B-752: ENGINEER AND EXECutive, technical education plus training in business administration; 12 years' experience in manufacturing plant construction and consulting engineering; accustomed to positions of responsibility requiring exercise of both initiative and diplomacy; well trained in systematic control of costs; desires permanent connection with growing industry where engineering knowledge is essential; salary to start, $6,000-$10,000.

B-753: GRAD. C. E. TWENTY-five years' exp. in design, construction and operation of railroad, mining and municipal engineering. At present consulting engr. specializing on water works and electric light plants, is open for proposition of magnitude. Will consider (1) going abroad on large engineering project. (2) Managing manufacturing concern, or (3) position with large public service corporation. Best references.

B-754: MECHANICAL ENGIneer, age 35, technical education, thorough knowledge of the construction of power plants and the operation of the steam dept., also several years' experience as supt. of light and medium machine shop employing 500 people. Local position desired.

B-755: GRAD. C. E. WITH broad knowledge of concrete and steel structures from designing to superintending their construction, seeks position with industrial firm or railroad company. In charge of designing. Best references.

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A Description of the Kathleen Mine Plant at Duquoin, Illinois

By ANDREWS ALLEN, M. W. S. E.

Presented November 10, 1919.

THE "Kathleen Mine" described in this paper is to be taken more as a text than as a complete title and the writer will endeavor to discuss principles and reasons rather than confining himself to description.

Figure 1 shows the yard layout from the main tipple looking toward the airshaft. It may be said in explanation that a mining plant has two shafts, one designated as a main shaft and one as an air shaft. This cut shows one of the principal novel features of the plant, namely the level yard. A mine is usually laid out with the yard on a gravity grade so that the cars can be handled from the storage yard, called the "high line," by gravity, to the load tracks at the lower end of the yard where the loaded cars accumulate.

This plant is situated upon a very flat piece of territory. The natural grades are very small and the water level is very close to the surface, so that a gravity yard of the usual type would have necessitated a very heavy fill and a plant built upon filled ground. Partially on this account and partially for other reasons which will be mentioned later, the construction of a level yard was decided upon.

This level yard is two tracks wide for the most part with a 36-inch gage shunter track running between them. On the shunter track runs a small locomotive, shown in the cut. Behind the locomotive is a flat car on which is mounted an apparatus with two shunter arms which can be operated by the man in the cab. These shunter arms are shoved in between the cars and in this way the engine on the shunter track moves a string of empties or a string of loaded cars up or down the tracks, brings the empties down from the storage yard and takes the loaded cars over the scales and into the load yard.

Figure 2 shows a view of the same yard from the air shaft

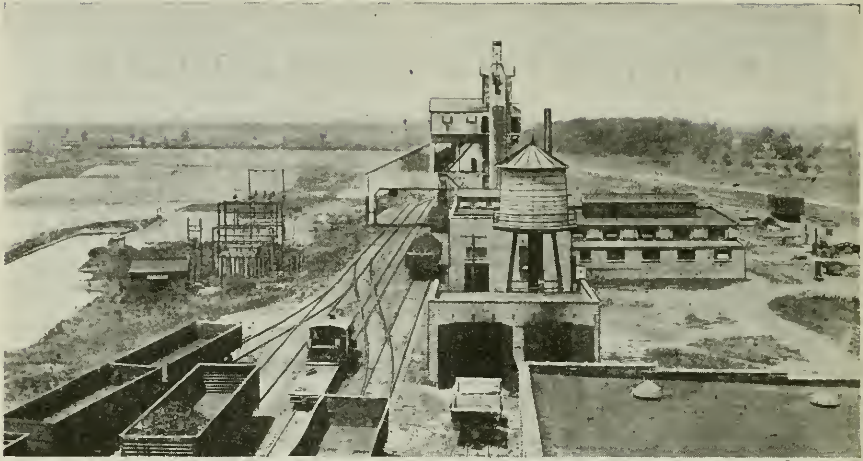


Fig. 1. Yard from main tipple.

tipple, which is 520 feet from the main shaft in accordance with the Illinois mining law, which requires 500 feet of natural strata between the two shafts. On account of the fact that probably 30 or 40 per cent of the product of the mine is slack coal, the shunter track was placed between the slack track and the nut track in such a way as to equalize the supply of cars. On the two-track empty yard it will be noticed that the cars cannot be passed from one of the empty tracks to a loading track on the other side of the yard without using a cross-over and obstructing the shunter track. It

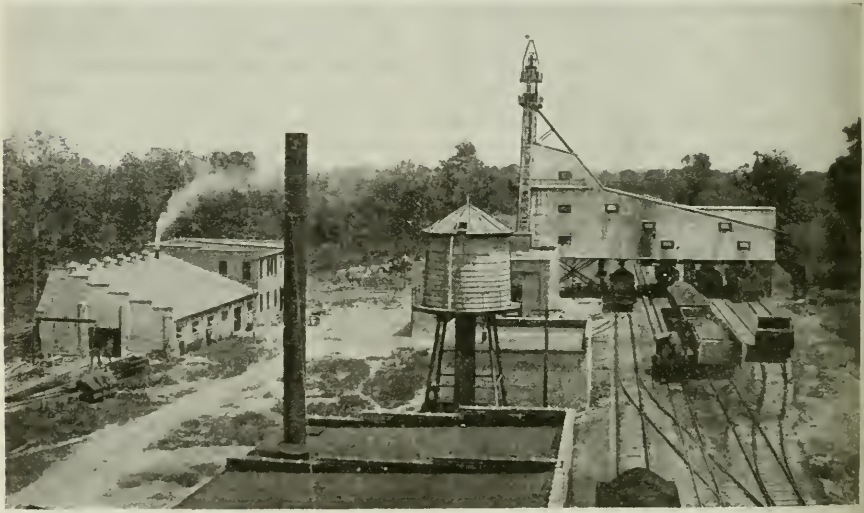


Fig. 2. Yard from air shaft tipple.

was therefore desirable to secure as nearly as possible an equal distribution of cars without passing over these cross-overs.

Now the second notable feature of this plant is the fact that the coal is hoisted in skips instead of in cars, as is the usual practice. The old mines which were built for capacity up to a thousand tons a day were built with platform cages in which the cars were hoisted on the cages and shoved off by man power, or mechanically in the larger plants, dumped, then sent back again and put on the cage. Then came the self-dumping cage, which greatly increased the dumping capacity of the tipple. The self-dumping cage is at the present time the principal means of dumping coal in these middle states where shaft mines are almost universally necessary, but the self-dumping cage has been pushed to the limit. In order to obtain large capacities, to reduce costs and increase profits, and to supply the coal that is required by industry, the speed of hoisting has been increased to a tremendous extent. No one not actually familiar with the speed of hoisting at coal-mining plants can appreciate the speed with which this operation is effected. There is a mine in southern Illinois where the cars average about four and a half tons of coal each and the hoist is 600 feet and where the world's record of 6,777 tons for a day's run was made by hoisting for eight hours at a rate of a little better than three hoists per minute, with an average rope speed decidedly over 4,500 feet per minute. Many smaller mines with lighter cars and shallower hoists make four cars per minute or better during shorter periods. This involves a complicated cycle of operations, including taking the empty car off the cage and putting the loaded car on and caging it in automatic keepers in such a way that when the cage is dumped violently the car will stay there and will not be disengaged. This operation must be continued with the utmost regularity and precision. The signal is given, the hoisting engineer opens the throttle and the cage comes up like lightning. He cuts off just as it comes to the ground landing, reverses or "plugs" the engine as it goes into the dump, and waits for his next bell, when it goes down again and the same process is repeated. All this is magnificent, but it is done at a tremendous expense. The speed and violence of the operation wears out the parts, breakdowns are frequent and stoppages and delays occur continually.

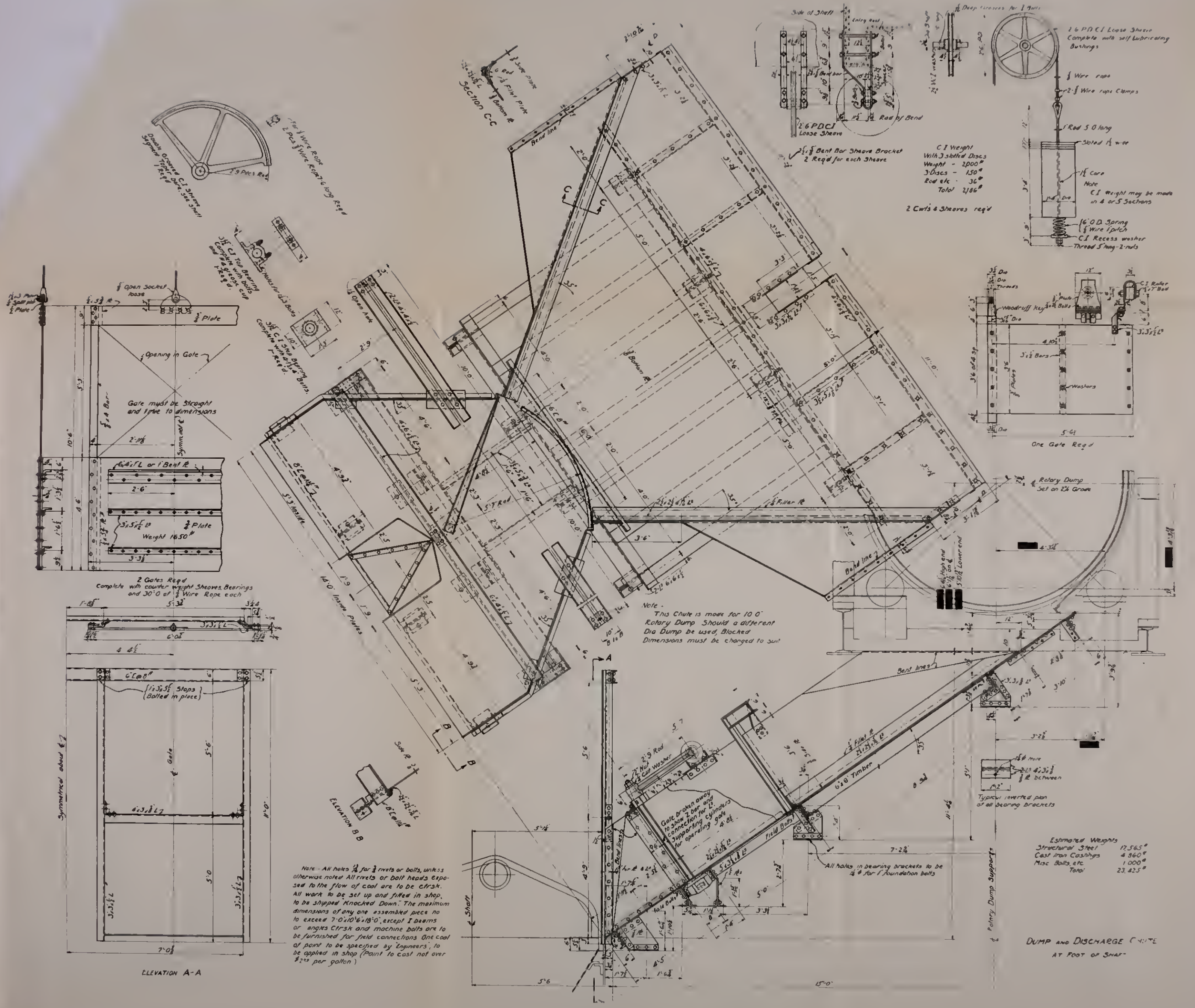
The problem before those engineers who are engaged in solving the problems underlying the design of coal mines of large capacity has been how to develop a mine which will have a large capacity without involving these tremendous hazards in operation, and so the skip hoist has been developed. Of course it is nothing new. The metal mines have used skips for a great many years. The overturning type of skip, as usually employed in metal mining, is called the Kimberly skip from the fact that it came, in its present form, from South Africa and is in use in the copper and iron mines. The Kimberly skip consists of a rectangular box pivoted at the bottom and with engagement at the top that enters a long guide and over-turns to perhaps 45 degrees with the horizontal. The Kimberly skip as it is usually built is not especially adapted to a coal mining plant. It is rectangular shaped, and this, with its very great depth, makes it adaptable to materials where breakage does not matter. In coal mining, with all the speed of operation and the tonnage required, you must be as careful of the coal as if you were handling a basketful of eggs. Breakage means degredation and a lower average price. For this reason the skip that we adopted in designing this plant was proportioned to give loading conditions without unnecessary breakage, and an easy dump at the top where the coal would flow out rapidly but with no serious drop. The skip was not put in as a new stunt, but as a method which has been devised to meet the growing demand for capacity at the coal mining plants.

I might say in this connection that the C., B. & Q. Railroad has a new plant at Valier where we put in a skip of the same type. Mr. Scholz is here this evening and I hope we shall hear from him after I am through. There are other skip loading plants in operation and building, one that we are building in western Pennsylvania at the present time which probably will be even larger than this, and one for the Toluca Coal Company in the northern district of Illinois, where the skips have now been in operation for about six months. This mine went into operation in July at the main shaft and we have had an opportunity during that time to study the results and the mechanical processes involved, to find the weaknesses and good points and seek methods for improvement.

As an illustration of the tremendous capacity that can be obtained with a skip mine I will say that in this case the skips each hold two mine cars of coal. The mine cars will hold about four and one-half tons. This means that nine tons of coal is taken by the skip in every load. The hoisting cycle is about two and one-half hoists a minute, giving 22½ tons a minute, or 1,350 tons per hour of continuous hoisting. Six hours of hoisting gives 8,100 tons per day, which is only three-fourths of the theoretical capacity. The central idea in a skip mine is to put the hoisting capacity beyond reach of the mining and dumping capacity so that any coal that can be mined can be hoisted and prepared. The Valier plant in the short time it has been in operation has already hoisted at a rate exceeding 1,000 tons per hour.

Now, in order to operate in skips the problems at the bottom are the big ones to solve. At the top it is easy, very much easier than with a self-dumping cage.

The most difficult part of the problem is to get the coal out of the mine cars and into the skips. In this case we adopted the "Wood pneumatic rotary pump," which turns the cars over and thus empties them without the use of end gates. The cage of this rotary dump holds the cars by means of lugs which engage the curbing angle at the top of same and is rotated and brought back to normal position by means of air cylinders and cables. Many dumps are designed to make a complete revolution of 360 degrees and there are



advantages in both methods, but the principal advantage in the method we have adopted is that the cage comes to a positive stop at both ends of the dumping cycle. The dumping cage rotates away from the hoisting shaft and the coal therefore does not drop, but slides against a shield into the chute and directly into the skip. Between the skip and the chute is a safety gate to prevent leakage or spill when the skip is not in loading position. The skip when descending engages a lug on the gate, carrying it down and thus opening the chute.

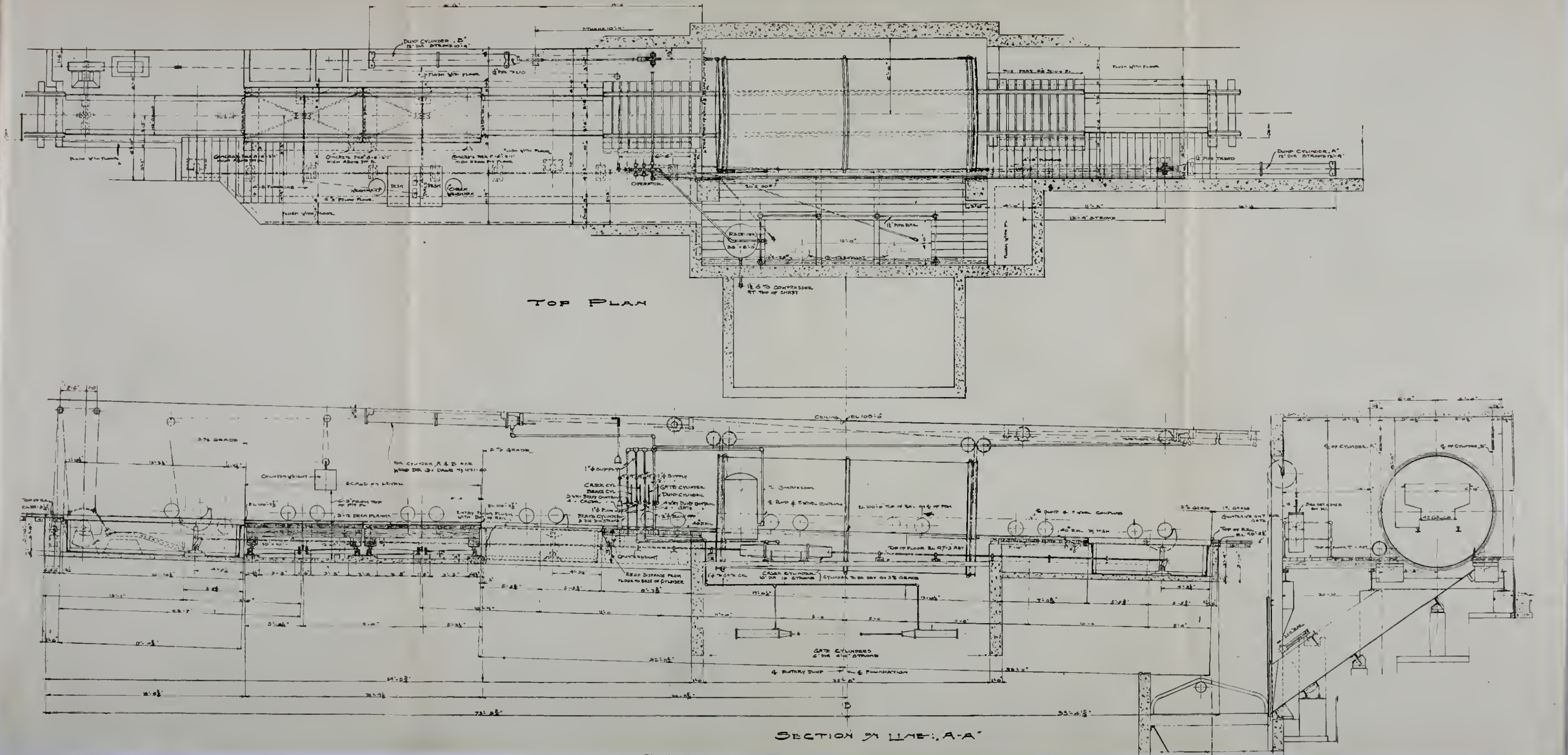
Any coal lying in the chute flows automatically into the skip. It is not intended, however, to hold coal in the chute. The idea is to build a skip which will hold exactly two carloads of coal, with surplus enough to take care of the excess loading of the cars. When the coal is dumped two carloads are taken into the skip. A butterfly gate operated between dumps throws it to one skip or the other. When the skip comes up the safety gate rises with it, being carried by means of counterweights. We found in practice that it was necessary to put in a spring engagement between the safety gate and the skip. While the safety gate is not very heavy, there was too much impact and we could not hold the rivets in the gate engagements. The spring gate appears to remove all the troubles. The gate floats down and up again with the skip without excessive shock and with the utmost regularity. There is also another very important feature not shown very plainly in the cuts. There is an apron that comes in contact with the safety gate in order to prevent spill between the lip of the chute and the skip. The plate is formed to a circular bend and comes in contact with the gate in such a way that practically no spill takes place between the chute and the skip. I don't know how often they have to clean the dump, but it is not very often, probably not oftener than once a month. I do know, however, that they did not have to clean it at all in the first two months' operation.

The alternative to the above is, of course, a storage hopper of moderate or large capacity, with either a direct power operated gate or some form of measuring hopper with a gate filling the skip automatically. There are advantages, of course, in such an arrangement, but in this case we believe they are outweighed by the disadvantages of breakage and first cost. The big hopper with a power-operated gate gives the advantage of storage of coal at the bottom of the shaft and of dumping freely without reference to the hoisting cycle, but with the tremendous dumping capacity afforded by the two-car rotary dump the advantages of large storage are confined to getting the cars back to the face in a little shorter time, or, in other words, increasing the output per car. Whether you can store coal to better advantage in cars or in the hopper is a question of figures that usually turns out in favor of the cars. There is also considerable breakage in dumping the coal into a deep bin and, where a measuring hopper is not used, uncertainty in loading the skip to capacity. The skip hoisting plant at Zeigler, Ill., is operated in that way. The hopper is filled with coal and the skip is filled by means of a power-operated gate controlled by an operator who has no way to judge except by eye whether the skip is full or not. As a consequence he generally either overfills it or underfills it and the results are not satisfactory. Where the measuring hopper is used we avoid all difficulty in filling the skip to capacity, but we still have the breakage both in the initial dump and from the action of the cut-off gate.

The next problem is the handling and dumping of the mine cars at the bottom. (See cut No. 4.) The cars are brought to the bottom in trips or trains of from 25 to 50 cars drawn by electric locomotives. At the bottom they are usually handled by gravity. In this case the natural grade of the coal between the main shaft and the air shaft was some 5 or 6 per cent, which made it impossible to get a good operating gradient on this line without excessive cost. For this reason the bottom was forked to the right and left nearly on the strike of the coal seam and leaving only enough straight track for the dump, scales and controlling mechanism. In this way we obtained a grade of about 1½ per cent for the standing loads, 3 per cent around the curves and over the cages, level over the scales and 2 per cent over the dump. The grading of the bottom was not excessive and the operating grades are about right.

In handling the cars through the rotary dump, dumping them, taking them down to the empty yard, collecting them into trips and taking them back into the mine, you have a problem of transportation that is equal to any problem in surface railroad operation. The usual method is to uncouple the loaded cars above the dump, let them go into the dump by gravity and cage themselves automatically, during which process they knock the empty cars through ahead of them. The grade above the rotary dump must be such that the momentum of the loaded cars coming down will be sufficient to disengage the empty cars and run them through. There must also be automatic engaging devices on the rotary dump to hold the cars in proper position. This is the ordinary method of handling cars in a cage-hoisting shaft mine and is rapid and satisfactory except for the rough usage which the cars receive and the useless labor of coupling and uncoupling. But we had been working for a good many years on the idea of taking the trips through continuously without uncoupling them at all. This arrangement is not new; in fact, I have seen old operations in the Southeast where this principle is employed. It involves, of course, some method of swiveling the cars on the couplings and also some method of starting, accelerating and stopping the trips; also weighing the cars while coupled. You will appreciate that the problem of starting a long trip rapidly, accelerating to the proper speed and stopping it at the right point, weighing a couple of the cars each time when they come to rest, and then repeating the process two and a half times a minute throughout the working day is not an easy one.

In this case we designed a bottom with three automatic cager


TOP PLAN

SECTION ON LINE "A-A"

Fig. 4. Bottom arrangement in elevation

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Weighing a couple of the cars each
then repeating the process two and a half times a minute throughout the working day is not an easy one.

In this case we designed a bottom with three automatic cager horns for holding the trip when properly registered with the dump and scales. One of these horns is above the scales, one below same and one just below the dump. The cager horns are operated by toggle levers from an air cylinder situated alongside of the dump. The cagers were furnished by the Connellsville Manufacturing & Mine Supply Company and are of the "Lepley" type. The two cagers above and below the scales were put in for the purpose of controlling the loaded cars and also getting a slack coupling between the cars on the scales and allowing them to be weighed accurately without uncoupling. The distance between the upper cager and the second one is a little less than the extended length of the cars with their couplings so that the weight of the cars in the dump is carried by the second cager, and the track over the scales being level, there is no apparent error in the weighing of the cars.

The trips are handled on an average grade of slightly less than 3 per cent. Roller bearing cars will start on a 1 per cent grade and will run on a grade sometimes as low as ½ per cent. So there is no trouble in getting the trips to start quickly when the cager horns are released. The difficulty lies in controlling the speed and stopping them without too much shock. The cager horns will not stop them when they have accelerated for 24 feet, and it was therefore necessary to adopt some mechanical method for controlling the speed of the trip and bringing it to a partial stop before entering the cager horns. We therefore put in a chain retarder, which is a very heavy car-haul chain having fixed lugs disposed at such intervals that they will engage lugs on the bottom of the cars as they come to the retarder. The retarder has no motive power but the trip itself and is controlled by a brake operated by an air cylinder. At first we had a good deal of difficulty in getting the brakes to work delicately enough. Whenever the air valve was opened the trip would stop with a jerk and it was only after we had throttled down the air line and the operator had acquired some skill in handling the valve that we got good results. Now, in practice the trip is always under perfect control. The operator first drops the cager horns which starts the trip, then as the cars gain momentum, he puts on the retarder brake, holding them at a uniform speed and retarding them just before they drift into the horns, which are thrown up into active position just before the proper car reaches them. The cagers all work in synchronism and the cager just below the dump holds the weights of the empties and permits a slack coupling where a coupling pin can be pulled and the empty cars detached.

The entire operation of controlling the trips and dumping the cars, as shown in cut No. 5, is handled by one man. There are four valves in front of him, as you see in the cut, one for the butterfly gate in the chute, one for the dump, one for the cager horns and one for the retarder. He has no difficulty in handling two dumps per minute or better, representing a dumping capacity of about one thousand tons of coal per hour.

Cut No. 6 shows the main tipple, which is of the well known

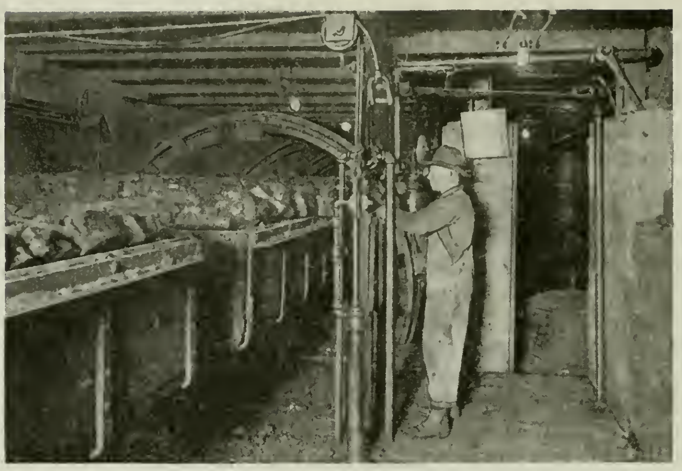


Fig. 5. Photo of rotary dump.

"A & G" "three-legged type," as they call it. The main feature is simply that the superfluous columns and bracing have been eliminated. The guides are carried directly by the columns and the sheaves are carried by the same columns and the back brace without the use of cross-girders. In this tipple, however, we introduce a comparatively new feature which is that the back of the shaft and a little more than half of each side is concreted around the steel. This leaves the outside of the shaft entirely free and thoroughly

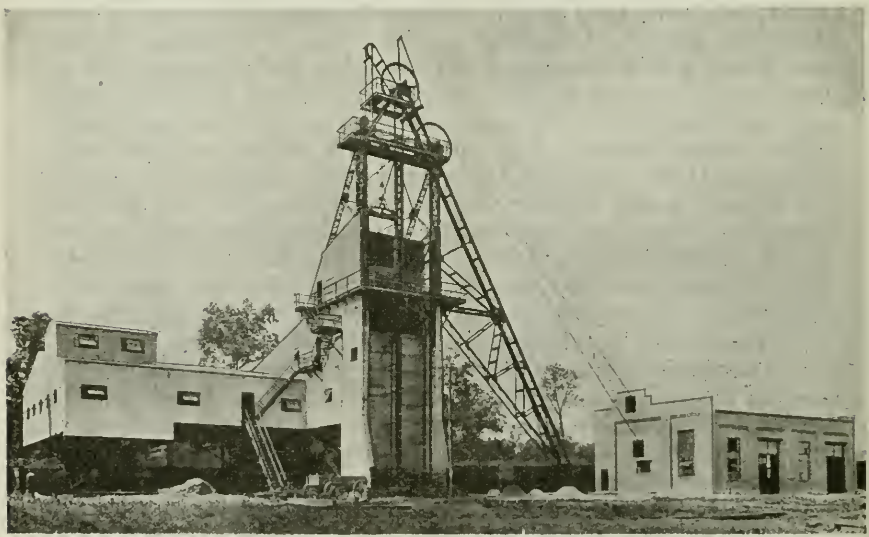


Fig. 6. View of main tipple.

protects the steel work against gases rising from the shaft. It also adds rigidity to the hoisting tower and of course allows the use of somewhat less steel in the tower legs.

The dumping point is only about 46 or 47 feet above the track level. For a cage-hoisting mine of equal capacity this height would be between 55 and 70 feet, so that the skip eliminates some height as well as a lot of mechanism in the top works. The illustration also shows the 10-foot diameter sheaves and the method of changing them by means of a little steel gin pole handled by a winch on the platform and rigged so that it can be lowered into position to take down one sheave and replace with another.

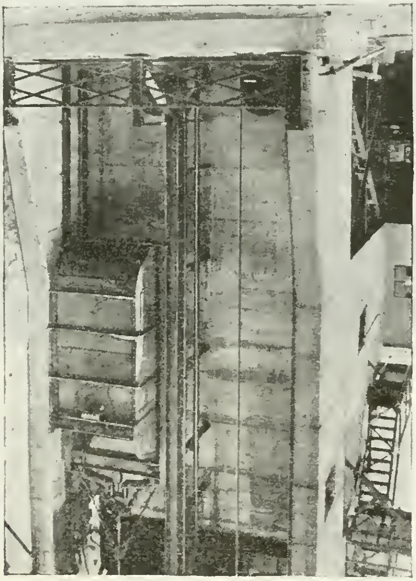


Fig. 7. Shift and skip.

Figure No. 7 shows the concreted shaft in more detail and also shows how the middle guides are held by the cantilever beams from the back of the shaft. This also shows the two sets of guides on each side, one for guiding the bale and the other for keeping the skip from dumping in the shaft and leading it into the dumping circles, which are a continuation of same. The designer has the option of using this method (to secure the skip in a vertical position) or a latch with engagements in the tipple to release same when the skip enters the dumping circles. As this shaft was rather shallow and also because we wanted something as near fool-proof as possible we decided to use the four-guide design. This cut also shows the skip going up the shaft. It will hold about eleven tons of coal and is about twenty feet from the bottom to the cross-head. This cross-head is made with a safety device of the "Lepley" type, which will operate and catch the skip in case the rope or the load chains break.

Figure No. 8 shows the general layout of the screening apparatus with the skip in its dumping position. The feeder is a very heavy pan conveyor with the additional feature of a wearing lug in the middle of each pan with a rail track underneath so that no suddenly applied load can bend the pans beyond their elastic limit. They will only hit the rail and slide on it until the load becomes relieved.

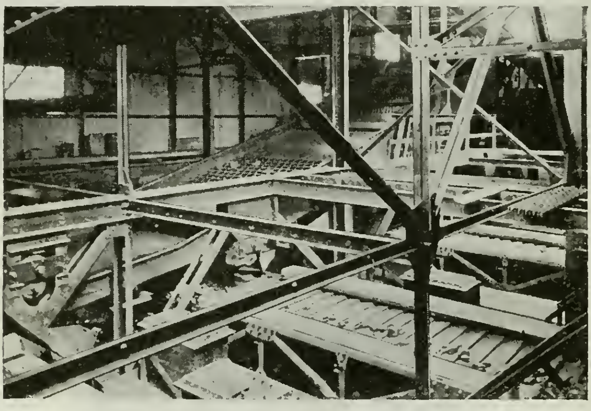
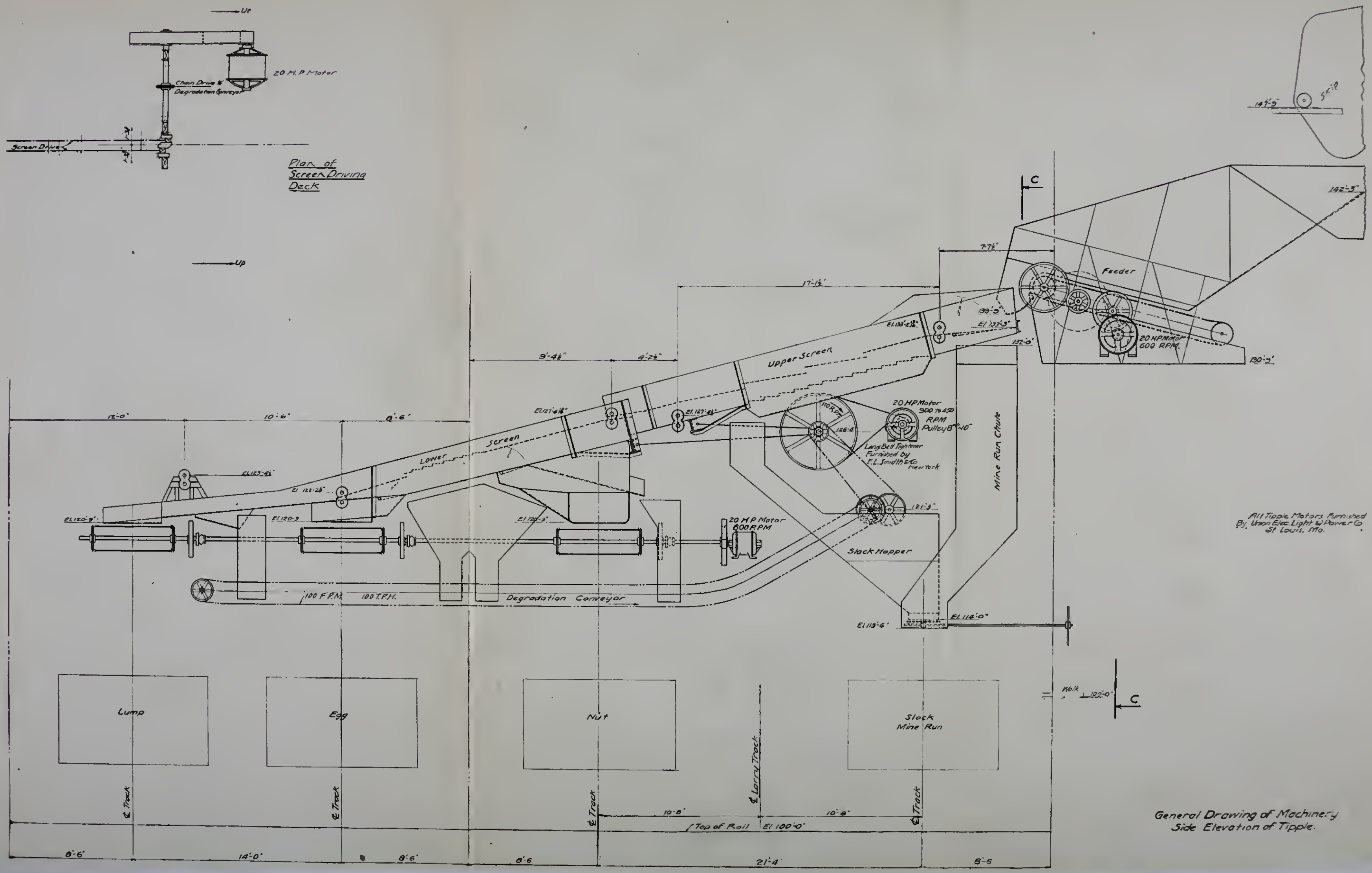


Fig. 9. Photo of screen, picking table and changes from operating platform.

The screen is carried by "Petersen" pendulum hangers and driven by a crank drive, with one driving arm in the counter of each screen. The screen prepares the ordinary sizes of coal for domestic uses, namely, lump, egg and nut, and the slack goes on the first track, also mine run. The coal suffers a certain amount of breakage in passing over the perforations of the screen, and this breakage is all screened out by the rescreening screens placed just before each discharge point, so that the coal is put on the picking tables just as clean as it can be and a conveyor carries the breakage back to the slack hopper. The picking facilities constitute an interesting feature of the plant. The refuse from the picking tables is usually of two classes, burnable and non-burnable, the latter consisting of slate and rock and the former of impure coal or sulphur which has a fuel value. For that reason there are two conveyors to carry the refuse. The pickers have two hoppers between them and can throw the burnable refuse into one and the non-burnable into the other. The burnable refuse will go up into a bin not yet constructed to hold a car load of coal, which can be loaded into cars and sold as an inferior quality of coal or burned under the boilers. The unburnable refuse is stored in a small bin above the shunter track and is used for ballasting, building roads or wasted.

The mine run chute loads mine run directly from the feeder



All Tipple Motors Furnished By Union Elec. Light & Power Co St. Louis, Mo.

General Drawing of Machinery Side Elevation of Tipple.

the burnable refuse into one and the non-burnable into the other. The burnable refuse will go up into a bin not yet constructed to hold a car load of coal, which can be loaded into cars and sold as an inferior quality of coal or burned under the boilers. The unburnable refuse is stored in a small bin above the shunter track and is used for ballasting, building roads or wasted.

The mine run chute loads mine run directly from the feeder and without passing over the screens. At the foot of the chute there is an undercut gate under control of the man loading the cars and who is thus enabled to load the cars uniformly and to maximum capacity.

The picking tables have hinged extensions which can be lowered into the cars so that the prepared sizes of coal can be loaded without needless breakage.

Figure No. 9 is an interior photograph of the tipple looking from the operator's platform. All the operations of the tipple are controlled from this platform, the screens, the feeders, all the conveyors, the picking tables and their hoists; also the car retarders by which the movement of railroad cars on the loading tracks is controlled. The shaking screens as mentioned above are hung upon pendulum hangers of the "Petersen"type. These hangers consist of short tension rockers or hangers, between 7½ and 9 inches long and give the screen a little vertical as well as a horizontal motion which is smooth and regular as well as helpful to the action of the screen. These pendulums are very easily installed and maintained and consume much less power than any other type of suspension or support that we know of. If the pendulums were of the exact length to correspond with the vibratory period of the screen it would take theoretically no power to run the screen, but the pendulums are considerably longer than that and only approximate the pendulum action. As it is, these screens which are among the largest in the field, are operated by a 20 HP. motor and probably consume regularly less than ten horsepower. We have made tests on screens nearly as large which consumed much less than this. One other reason for the low power consumption of these screens is, of course, the crank drive, which operates for a fraction of the frictional

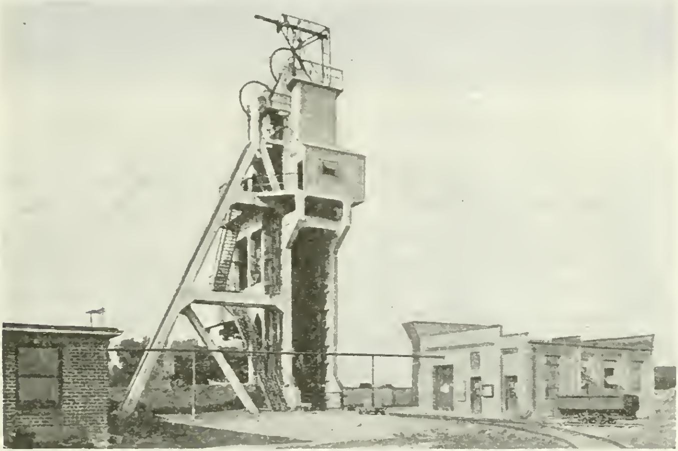


Fig. 10. Concrete tipple.

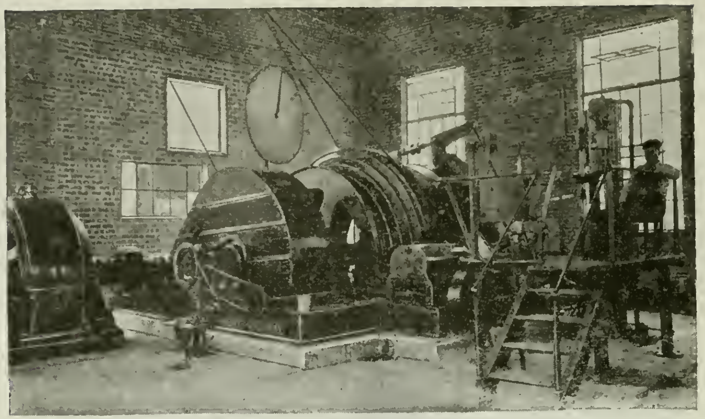


Fig. 11. Main hoist.

resistance produced by eccentrics and allows the employment of well designed driving rods with adjustments for length and wear similar to those used in engine design.

At the other end of the yard is the air shaft tipple. This was built in the early days of the war when the steel situation was extremely acute. In order to get material we decided to build a re-enforced concrete structure. The work was carried out very successfully under very severe conditions. It was built during the winter of 1917-18, which was the most severe winter we have had in forty years, and in the coldest part of the winter, starting about November 1 and finishing along in March. We had it covered up and camouflaged during construction till it looked like a German sausage balloon, but we kept it from freezing, and the result is a structure that has stood up to date with not a hair crack anywhere. In this tipple the cars are pushed off the cage in the old-fashioned way, dumped in a rotary dump located on the deck of the tipple and pushed back again. The coal goes over the bar screen and the lump is produced on one track and the slack on another. Cut No. 10 shows one view of this most interesting structure. Now that the main tipple is working they will use this only occasionally for emergencies. Its principal use is to handle men and materials, which will be done entirely by this tipple, and also for handling rock. The air shaft tipple was also used for about a year for hoisting coal during the development of the mine and before the main tipple was placed in service and is capable of handling in this way about 1,200 tons per day.

In this connection the main power plant transformers and motor generator sets and switchboard are at the air shaft, the idea being to operate the air shaft twenty-four hours a day, as the mine has to be active at all times for various operations mostly connected with maintenance and construction. The man in control of the hoist

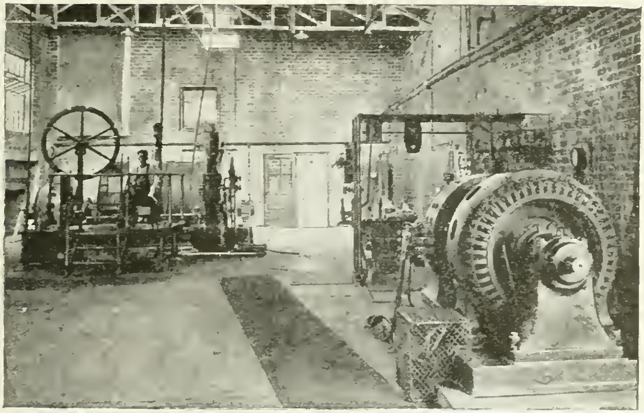


Fig. 12. Air shaft hoist.

is in the same room as the motor generators and looks after them also, while the main hoisting plant is an eight-hour proposition locked up at the end of the day.

Central station power is used at this mine and steam is used only for heating. The current is transformed from 33,000 volts to 2,300 volts and used at this voltage in the air shaft hoist and the motor generator sets. It is also taken into the mine at this voltage and transformed near the face to the working voltage of 230 volts A. C. Only the haulage motors and the main hoist are operated by direct current. Figure No. 11 shows the main hoist, which has a cylindro-conical drum with Herringbone gear drive, encased, and running in oil, connected to a D. C. motor. The hoist is designed

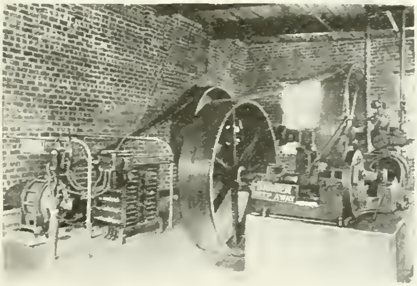
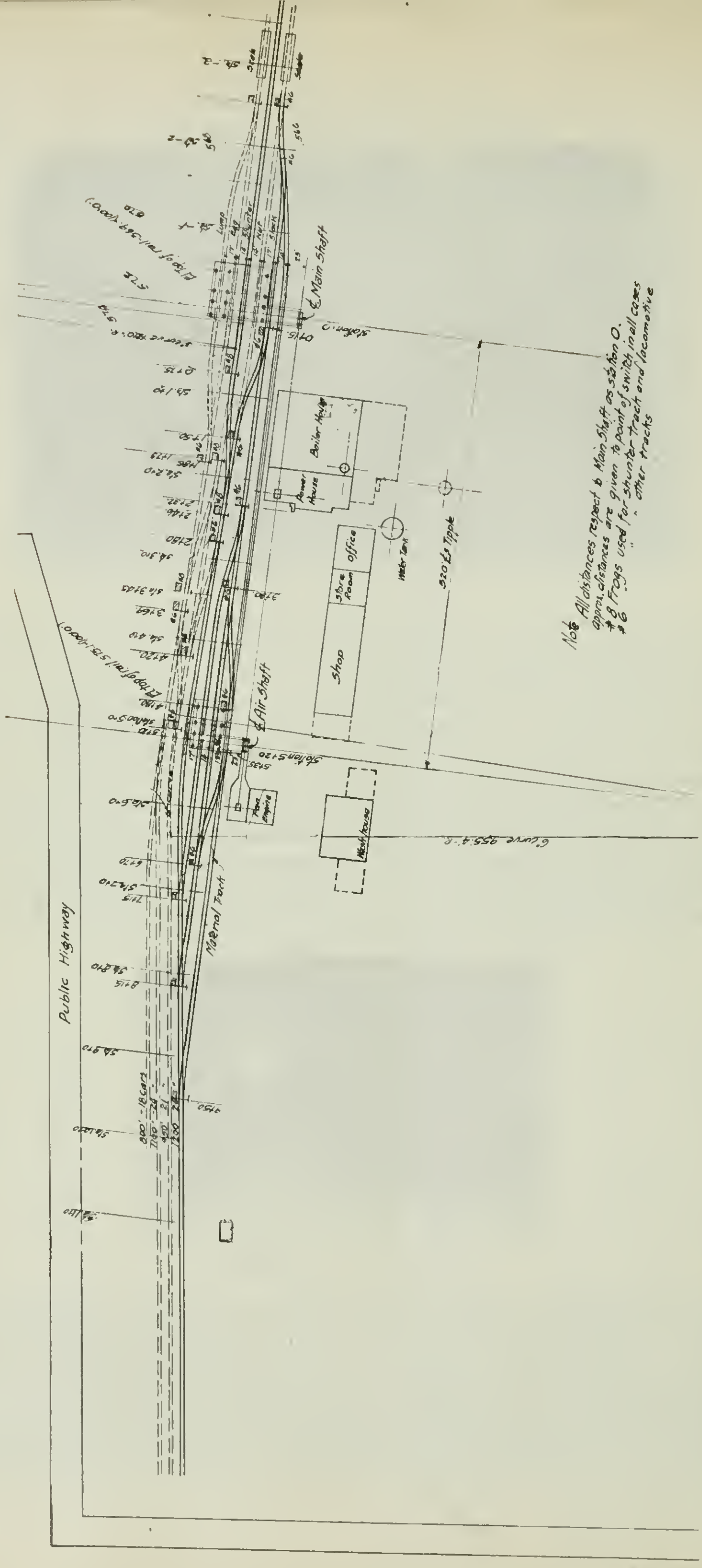


Fig. 13. Fan house interior.

for comparatively slow hoisting speed and is quite economical in power consumption, partly by reason of the cylindro-conical drum, which causes the skip in the dump at the tipple to partially balance the loaded skip at the bottom of the shaft. The control is of the Ward-Leonard type with an "Illgner" flywheel set with casing to prevent air resistance. The air shaft is of the geared type same


Public Highway
Material Track
℄ Air Shaft
℄ Main Shaft
Boiler House
Power House
Shop
Store Room
Office
Water Tank
320' ℄s Tipple
Fan Engine
Wash house
6° curve 955.4-R
Station O.
Station 5+20
Note All distances respect to Main Shaft as station O.
approx. distances are given to point of switch in all cases
#8 Frogs used for shunter track and locomotive
#6 " " other tracks

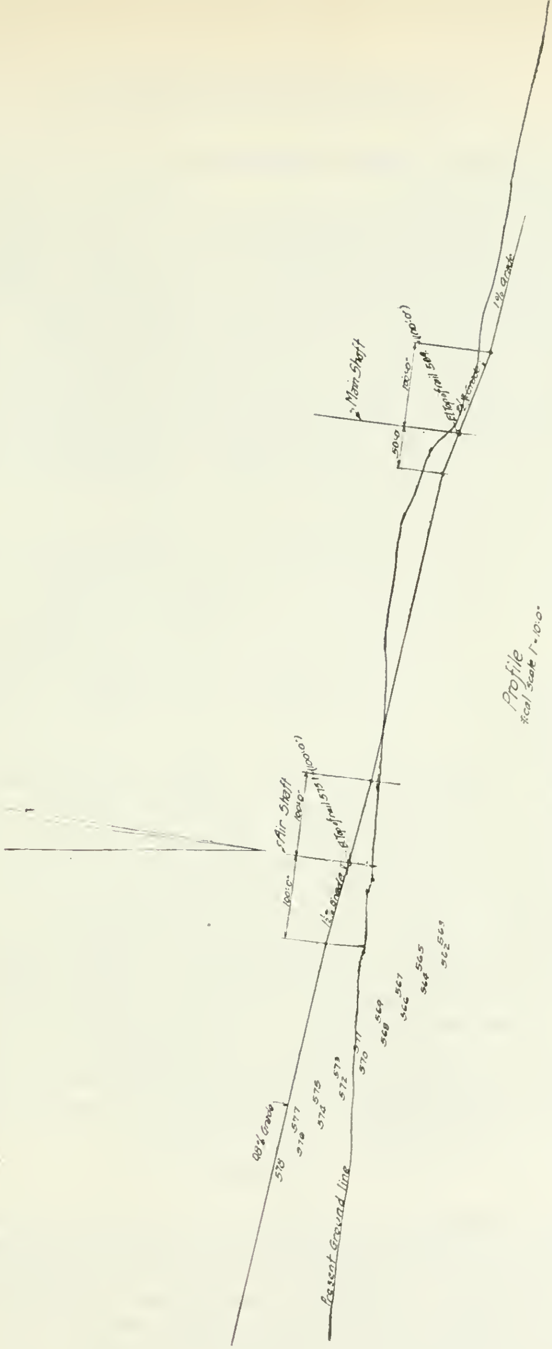


Fig. 14. Yard layout.

as the main hoist, but has a cylindrical drum with an A. C. motor, as shown in cut No. 11.

Cut No. 13 shows the interior of the fan house. The fan installation is also shown in cut No. 1. The regular drive is an A. C. motor (a small motor is installed at the present time and will afterwards be taken out and a larger one substituted). The auxiliary drive is belted from a 12 x 16-inch throttling engine. The steam is supplied by the boilers which heat the water for the wash house and which can be operated at 100 pounds pressure if required.

Every plant running on purchased power should have an auxiliary steam unit at least sufficient to run the fan and send air into the mine if the power should go off. In one plant we are now designing the auxiliary steam plant is sufficient to operate the air shaft hoist as well as the fan.

As I said in the beginning of my paper, the description of the Kathleen mine should be taken more as a text for discussion of the principles involved, and I have tried to bring this out as I went along. There are certain ideas in this plan which are far from finalities. Every improvement in the art of building coal mining plants, as well as in every other art, goes through evolutions, and each designer must be satisfied if he contributes something in the right direction.

The next cut, No. 14, shows a development of the Kathleen yard plan, which we regard as a decided improvement. The yard is or may be flat, but the main feature is that a standard gage shunter track runs through the entire yard, so that the shunter locomotive may be standard and so that it can go on any track as may be required. The shunter track also becomes the "run around" over which the empties are run into the storage yard. This change makes for greater elasticity and gets the maximum service out of the shunter locomotive. The material track comes off the high line and can be used for standing cars, either above or below the air shaft, without interfering with the operation of the mine. There are also many additional features and improvements contemplated or in course of construction in the Donk Brothers plant for which this yard was designed, but I should exceed the proper limits of this paper if I should attempt to cover them here.

DISCUSSION.

Mr. Haggander: Gentlemen, the paper will now be open for discussion. We have nearly an hour to talk this thing over.

Mr. Dilling: I would like to ask if the results obtained up to date through using re-enforced concrete for coal tipple construction have been such as to warrant its use in place of steel except in cases of emergency such as you have described.

Mr. Allen: You said "up to date." Possibly, because there has not been enough of it done up to date, the results have not been comparable with steel as regards costs, unless the life of the tipple is considered and general stiffness, stability and appearance. The cost will come down, of course, as people become more familiar with handling work of this kind.

Mr. Dilling: Isn't it a fact that these tipples are considered more or less temporary structures, depending on the life of the mine?

Mr. Allen: Yes, but any of them may have a long life. They frequently have a life that will warrant very good construction. This mine will have a life of thirty or forty years. Many of the mines are very long lived, of course barring accidents.

Mr. Dilling: In this connection it is well to keep in mind the use that has been made of light aggregate for concrete construction, an aggregate having been produced that will give a strength 50 per cent greater, and with a third less weight than ordinary concrete.

Mr. Pendell: I understood you to say that you had a single motor and it wasn't like Mr. Allen's outfit. I would like to ask next what Mr. Allen thinks of the point, or the depth of the shaft that decides when to go from a cylindrical drum to the conical drum. I suppose that is the point he decided his type of drum on, or do you use the conical on all depths of shafts?

Mr. Allen: I don't think that the depth of shaft has a lot to do with that. Accelerating and stopping the load is the place where the cylindrical conical drum has the advantage. You accelerate and stop the load oftener in a shallow shaft than you can in a deep shaft. However, the shaft does have a very great bearing on whether to use a direct connected or a geared motor. I will entirely agree with Mr. Scholz that he did the right thing in putting in a direct connected motor. He will probably agree with us that in a shallow shaft you should use a geared motor. The reason that we use the D. C. was because the pull on the line was too great without it.

Mr. Garcia: Inasmuch as there are about a hundred old mines to one new mine, since the underground approach to the shaft is 180 degrees, in skip hoisting from the cage room in self-dumping cage hoisting I would like to have him explain the method of applying the skip hoist to existing mines. The opportunity there is more or less unlimited. You build one new mine a year, but there are mines all over the United States where they try to get a very great tonnage, but they can't do it on account of the low rope speed. If they could put in skips they could get the same tonnage with one-half the rope speed.

Mr. Allen: The nearest we have gotten to this up to date is by means of a weigh pan or two weigh pans disposed in front of the shaft, and with a two-car rotary driving at right angles to the old bottom. We have also discussed practically every possible combination. I don't know that we have omitted a single one, putting the dumps in every conceivable position. A diagonal location with a curved chute and without the weigh pans also looks hopeful and will lead to a much less reconstruction of the old bottom.

Mr. Leisner: I would like to ask Mr. Allen to tell us something about how the coal is handled before it comes to this operating plant; that is, if it isn't too far outside the subject. I don't know a thing about how much machinery they have now. We used the pick and shovel. They speak of their inventions, that before the coal comes to the head of the shaft it is a question of faces, but I would like to know just how much has been done in the way of machinery to make these faces more efficient.

Mr. Allen: I will have to plead that I am not a mining engineer. I would like to pass this question on to my partner, Mr. Garcia or Mr. Scholz.

Mr. Scholz: I will make a very short statement on that. We equipped in the Vallier mine in the earlier stages two inter-driving machines, a machine which undercuts, breaks down and loads coal in one operation. This machine was built on the Morgan patents and, as far as I know, on October 31, the two machines at the Vallier were the only ones in operation in the United States. Our object in purchasing these two machines was, first, to gain speed, and we have achieved some very remarkable results. In one week we drove 450 feet of entry way with a single machine. Ordinarily with breast machines or short-wall machines 100 feet or up to 200 feet a month is considered the very best that can be obtained.

The second object in using this machine was to preserve our ribs, because the shaft bottom entries when exposed would shear off very badly and cave in after a very short time, but where the ribs are sheared from solid walls they are just as smooth as the walls of this room. The third purpose was that of safety by limiting explosives. There is only one barrier, and it is one that we see today when we read in the afternoon paper speaking about the miners' organization in their strikes. They have barred the adoption of those machines and are standing in the way wherever they possibly can. We were able to operate these machines for eighteen months in the face of the most violent opposition on the part of the men. How much longer we are going to be able to keep it up I don't know. There is a tremendous field yet to be covered with the adoption of mechanical mining and hoisting machinery. There are a number of loading machines on the market today, but none of them come up to this machine. When I made an arrangement with Mr. Farrington of the Illinois Mine Workers, he said to me: "I advise you not to put them in because you know the mine workers won't give you a chance to get what is properly due you." But by persistence and financial inducements we were able to keep these machines in operation and successfully so up to the present time. There are loading machines on the market today where one man will do as much with the machine as ten will do by hand, but unforunately we have not been able to introduce it successfully because of the opposition of organized labor to these devices.

Mr. Lowry: Mr. Allen's paper is so complete that it is hardly necessary to ask any questions. There is one point in regard to the locomotive that seems to be showing the cars that I would like to ask about. I think one objection might be raised to that in that the room required and the trackage are all under the tipple. It occurred to me that the same result might be obtained by the rope hauling system. In discussing the skip which Mr. Allen used in his plant it is evident that starting the heavy loads there is a great weight of skip required for this tonnage of coal, and the starting torque of the motor will be very large, because in the overturning type of skip, inasmuch as at the dumping period one-half of the skip rests on the front end in a horizontal position, so that only half of this weight is available to balance the skip into vertical position at the bottom, for this reason that the bottom dumping skip has the advantage there, inasmuch as the total weight of the skip is suspended at the period of dumping. In this skip the door on the side at the bottom, at the point of dumping, is tripped. This skip also has the advantage of not dropping so far in dumping, although I would not urge this as an advantage, as all engineers now believe that in handling coal in large masses it does not produce much dust or slack, it sort of flows out.

Mr. Allen: Mr. Lowry has asked a question which brings up a very interesting phase of this matter which I didn't dwell upon very much; the fact that he brings out regarding the weight of the skip that is carried on the dumping guides in the tipple is very true, indeed, and that was one of the reasons that we used a cylindro-conical drum, to offset the loss of load on the cables. As far as the bottom dumping skip is concerned, that is a mechanical proposition which means that the dumping apparatus has to be on the skip itself and has to be raised and lowered in the shaft, and while the advantages of the bottom dumping skip are attractive, and I am by no means sure that this type of skip hoisting will not be satisfactory, we wanted to tread in traveled paths so far as possible, and we know that the overturning skip is a safe proposition. Nothing is going to break about the skip; it is easy to keep it in the shaft and easy to dump it, and the unbalanced load can be taken care of. I am intensely interested, however, in the development of the bottom dumping skip. The "Lepley" bottom dumping skip has been in operation for two or three months and has been wholly satisfactory. Skips that Mr. Lowry has built, I presume, are also giving satisfaction. The development of the bottom dumping skip is a thing that I think we all ought to work on.

Mr. Haggander: This paper has certainly broadened out into a very interesting discussion. I thought there would be more along structural lines, but there really aren't as many structural features to the mine as you might suppose. I thought that the re-enforced concrete was coming into use more and more, but I see it isn't. The mine lining seems to be about the main use for re-enforced concrete in the mine.

Mr. Pendell: Mr. Allen spoke about having to use the motor generator sets on account of not being allowed to put the large size motors upon transmission lines. I would like to find out the largest motors that he has been allowed to put on transmission lines direct for hoisting anywhere in the State of Illinois.

Mr. Allen: I think that we put a 250 HP. motor on the hoist of the model for the mine at Benton. It was an A. C. auxiliary motor on the big hoist.

Mr. Pendell: That is a straight contact and control motor?

Mr. Allen: Yes, it is.

Mr. Pendell: I have been very much interested in the hoisting problem and appreciate what it means to the central stations to put on to their lines these hoisting loads which come on and go off so often. It takes a pretty rugged transmission line which, if 20 or 30 miles long, can stand a 500 kilowatt load. That doesn't look like a very large load, but that puts anywhere from one-half to one per cent fluctuation in that line, and it is a rather severe proposition for the central station to handle.

Mr. Haggander: If there are no further questions and no more discussion we will consider the meeting adjourned, with the thanks of the society to Mr. Allen for his paper.

State Registration of Engineers*

By Theodore L. Condron, M. W. S. E.,
Chairman, Committee on Licensing, Engineering Council; Member, Illinois State Professional Committee for Structural Engineers.

THE "Illinois Structural Engineering Act" was approved June 24, 1919, and revised the similar law which was passed by the Illinois Legislature in 1915. Under the later Act it is unlawful for any person to practice or to attempt to practice structural engineering (in Illinois), without a certificate of registration as a registered structural engineer.

The following persons are exempt from the operation of the Act: (a) Employees of registered structural engineers, when acting under the personal supervision of their employers; (b) superintendents in the pay of owners, when acting under the personal supervision of the registered structural engineer who prepared the plans and specifications; and (c) any person planning or supervising the construction, enlargement or alteration of any structure or building for his own use.

Persons to be qualified to receive a certificate of registration must be: (a) At least 21 years of age; (b) of good moral character and temperate habits; (c) have practiced structural engineering in another state, territory or country at least six years, two years of which in responsible charge as principal or assistant, or have pursued a course of training in the theory and practice of structural engineering for not less than six years in the employ or under the immediate supervision of one or more practicing structural engineers, during at least two of which years he has been in charge of work in designing or construction (graduation from an approved school of engineering, with a four years' course, being considered equivalent to two years of practice); and (d) in addition to the preceding, have passed an examination conducted by the Department of Registration and Education.

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* A paper read by Theodore L. Condron, Mem. W. S. E. Read before the Western Society of Engineers, June 21, 1920.

The Department shall hold examinations at such times and places as it may determine and such examinations *may* consist of written and oral tests and *shall* embrace the subjects normally taught in approved schools of structural engineering.

Regarding reciprocity with other states, the Illinois law provides that "an applicant who is a structural engineer, registered or licensed under the laws of another state or territory of the United States or of a foreign country or province, may, without examination, be granted a certificate of registration provided: (a) He is at least 21 years of age, of good moral character and temperate habits; and (b) that the requirements for the registration or licensing of structural engineers in the particular state, territory, country or province, were, at the date of the applicant's license, substantially equal to the requirements then in force in Illinois.

It will be observed that the Illinois law provides for the examination of all applicants, except those who are structural engineers holding a certificate of registration or license under the laws of another state, territory or country in which the requirements were equal to those of the Illinois law.

The Illinois law says but little about the scope of the examination, which may be written and oral and shall embrace the subjects normally taught in schools of structural engineering. The law, however, provides that the Department of Registration and Education may adopt reasonable rules and regulations relating to the enforcement of the law. The fees required of an applicant by the Illinois law are: For examination to determine his fitness to receive a certificate, $10; for a certificate of registration, $5; for an examination to determine his preliminary education, $5; for the restoration of an expired certificate of registration, $5; for the renewal of a certificate of registration, $1; and for a certificate to an applicant, registered or licensed under the laws of another state, territory or country, $15.

The professional features of the Illinois law are administered by a committee of structural engineers consisting of five persons, appointed by the Director of Registration and Education. The administrative provisions of the law are exercised by the Department of Registration. The powers and duties of the professional committee are: (1) To conduct examinations to ascertain the qualifications and fitness of applicants and to pass upon the qualifications of applicants for reciprocal registration; (2) to prescribe rules and regulations for conducting examinations; (3) to adopt rules for, and establish a uniform and reasonable standard of maintenance, instruction and training to be observed by all schools of structural engineering which are to be deemed reputable and in good standing and to determine the reputability and good standing of such schools; and (4) to conduct hearings on proceedings to revoke certificates of registration.

Applications for registration are required to be made on a blank form which may be obtained without charge on request, from the State Department of Registration and Education, at Springfield, Ill. Dr. Francis W. Shepardson is Director of Registration and Education and Mr. F. C. Dodds is Superintendent of Registration. The present members of the professional committee are Messrs. Andrews Allen, F. C. H. Arentz, I. F. Stern, Prof. F. H. Newell and the speaker, all members of the Western Society of Engineers.

Illinois is the only state having a law regulating the practice of structural engineering, but ten other states have passed laws regulating the practice of professional engineering and it is of vital importance to all engineers that state regulation of engineering practice be carefully guided by professional engineering societies and organizations in order that so far as possible such regulation shall be uniform and so framed as to be a benefit rather than an annoyance or detriment to the profession.

The laws already passed are so variable in their requirements and restrictions that engineers engaged in interstate practice are even now confused and embarrassed as to their rights and privileges. The professional committee for examining structural engineers under the Illinois law feels that greater weight should be given to the professional attainments of applicants than has been the rule heretofore. Therefore it has recommended to the Director of Registration that submission of evidence of qualifications to practice structural engineering be required of all applicants as part of the examination specified by the law to determine the fitness of applicants to receive certificates of registration. This is in line with the provisions of the proposed uniform registration law recommended by the committee of the National Engineering Council.

In the fall of 1918, Engineering Council appointed a committee on "Licensing of Engineers," the fifteen members of which were from thirteen different states and included structural, railway, municipal, hydraulic, mechanical, electrical and mining engineers.

After fourteen months of investigation and study, a report was made to Council with a draft of a uniform registration law recommended for the approval of Council. This draft was so drawn as to provide for the registration of professional engineers, architects and land surveyors.

The committee stated in its report:

> "The advantages claimed for State licensing or registration are . . . , that those who are incompetent and unqualified

> professionally to practice are unable to obtain certificates or licenses and hence both the public and the profession are protected. On the other hand . . . State licenses or certificates of registration are apt to put the seal of State endorsement on men who do not deserve it and the public would assume that a licensed or registered engineer was thereby certified by the State as fully qualified, regardless of what might or might not be the requirements demanded before a license or certificate was granted."

The bill drafted by the committee provides that certificates of registration shall be issued: (1) To any person *submitting evidence satisfactory to the Board* that he is fully qualified to practice; (2) to any person who holds a like unexpired certificate of registration from another state or territory of the United States or province of Canada, in which the standards are satisfactory to the Board; provided, he is at least twenty-five years of age, a citizen of the United States or Canada, or has made declaration to become a citizen of the United States, writes and speaks the English language, is of good moral character and has been engaged at least *six years* in the practice of professional engineering. Each year of teaching or study satisfactorily completed in a school of engineering is to be considered as equivalent to one year of active practice.

This proposed law also provides that certain "facts" when established in the application shall be regarded prima facie evidence satisfactory to the Board that the applicant is fully qualified to practice, these "facts" being somewhat beyond the minimum requirements. They include: (a) Ten or more years' active engagement in professional engineering; (b) graduation after a four years' course in engineering, together with four years' active engagement in engineering; (c) full membership in one of the four founder engineering societies or other national or state engineering societies approved by the Board. Where evidence originally presented in the application does not appear conclusive to the Board as warranting issuance of a certificate, the applicant may present further evidence, which may include the results of an examination, for the consideration of the Board.

Of the eleven states in which registration laws have been passed, only two have passed such laws since this proposed uniform law was reported to Council. These two states are Virginia and New York.

The Virginia law was approved in March of this year, and follows quite closely the proposed uniform law of Councils' Committee. Unfortunately, this law contains the objectionable feature of earlier laws which requires examinations of all applicants except those in practice at the time the law goes into effect. The nature of the examination proposed is left to be determined by the Board of Examiners. Under the Virginia law, the applicant must be at least twenty-one years of age, a citizen of the United States or have declared his intention to become such. However, the law is intended merely to protect the terms "certified architect," "certified professional engineer" and "certified land surveyor." Consequently, it is not necessary for an engineer to obtain a certificate of registration in order to practice in the state of Virginia, but unless he does obtain such a certificate, he may not use the term "certified engineer."

The New York law for licensing professional engineers and land surveyors became effective in May of this year and with regard to examinations has followed the recommendations of Council's committee on licensing, that is, examinations are required only in cases where the evidence originally presented in the application does not appear to the Board conclusive or warranting the issuance of a certificate, in which case the applicant may present further evidence which may include the result of a required examination.

The New York law also requires that all those practicing or offering to practice professionally one or more branches of engineering or land surveying, shall be licensed by the State. He shall have at least six or more years of active engagement in professional engineering work, one of which shall have been in responsible charge, of a character satisfactory to the Board of licensing. To practice land surveying, four or more years of active engagement in land surveying of a character satisfactory to the Board is required.

It will be seen that under the New York law, as well as under the proposed uniform law, an engineers' satisfactory record of work performed and the evidence which he is able to submit of his qualifications to practice in any branch of his profession is weighed by the Board of Registration. Therefore, an engineer who has already made a reputation for engineering ability should have no difficulty in procuring a certificate of registration either in his own or another state where such record and reputation are recognized as qualifications.

There are annoyances and difficulties about some of the laws now in force. In nine states, certificates will be issued only to those passing an examination. That is, in Colorado, Florida, Idaho, Illinois, Iowa, Michigan, Oregon, Virginia and Wyoming. It is true that in most of these states, an engineer holding a license to practice in another state where a similar law is in effect, may be excused from an examination. Consequently, regardless of the qualifications that an engineer may have or of his experience or reputation, he may have to submit to an examination, the character and scope of which is uncertain, before he will be permitted to practice his profession in these nine states. For instance, in the state of Illinois, a non-resident applicant for a certificate of registration as a structural engineer, must have passed an examination in some other state having equal requirements in order to be exempt from examination under the Illinois law. Consequently, men eminent in the profession and with many years of successful practice have been required to take an examination the same as though they were just entering the profession.

Engineers do not find their field of practice limited to a single locality as is generally true for physicians and frequently true for lawyers, but an engineers' practice usually extends over several states, and engineers of reputation are frequently summoned to advise and pass upon propositions outside of the state in which they reside, on very short notice. It is therefore against public policy to bar experienced engineers from interstate practice because they may not have qualified in each and every state by taking examinations and obtaining licenses in advance of any professional engagement in such states.

In order to obviate some of these difficulties, the proposed uniform law stipulates that a non-resident engineer may legally offer by letter, announcement or otherwise, to practice in the state without first obtaining a certificate. A non-resident engineer may also legally practice not to exceed fifteen days in any calendar year without being registered provided he is legally qualified for such professional service in his own state or country. This is intended to cover cases of professional consultation on emergency work. An equally important provision is made to cover the case of a non-resident or newly arrived engineer called upon to practice professionally in a state in which he is not registered. After he has filed an application for registration he is to be legally permitted to practice for such reasonable length of time as the Board requires in which to consider and grant or deny his application.

No such provisions as these just outlined appear in most of the registration or license laws now in force in several states, and engineers are certain to find that these laws, if enforced, will cause them embarrassment and annoyance, as their practice extends beyond the state in which they are residents.

Engineering Council has prepared a digest of each of the eleven registration laws enacted by the states referred to above for the benefit of engineers desiring information on this subject. Council has also addressed a communication to the program committee of the National Conference of Commissioners on Uniform State Laws, requesting consideration of uniformity of state legislation on registering and licensing of professional engineers, and giving reasons therefor. The writer has been designated to appear before this committee as representative of Engineering Council.

It seems to make very little difference whether individual engineers are in favor of such legislation or not, because of the fact that eleven states already have enacted such laws, and it is now important that the engineering profession unite in demanding uniformity of legislation and the elimination of unnecessarily burdensome requirements.

How Can We Increase Production?

Address Before Engineering Section, National Safety Council, Joint Meeting with Western Society of Engineers, Chicago, June 24, 1920

By Sidney J. Williams,
Secretary and Chief Engineer, National Safety Council.

PRODUCTION depends primarily on two factors—machines and men. Production also requires materials but these in turn are produced by other machines and men—using "machines" broadly to include all equipment. Production also requires capital to provide the machines and the men, and management to direct them. But machines and men are the immediate producers. They and they only can increase or decrease production. The things that cause them to do the one or the other are the things that we must study.

The basis of modern production, with respect to both machines and men, is regularity—standardization. The Swiss watchmaker a hundred years ago built his watch from the ground up, fitting each part to the parts already completed, as a carpenter builds a house. He never made two watches exactly alike. I believe the Swiss watchmaker still follows somewhat the same method. But we in America make our dollar watches (which now sell for two dollars) and our two dollar alarm clocks (which now sell for four) with dies and jigs and fixtures; we stamp out the parts on power presses or machine them in automatic screw machines, so that part number 106 always fits part number 105 exactly, although the men who make the two parts may never have seen each other and may not speak the same language. Whether in the eyes of an artist all the alarm clocks in America are worth a single beautiful Swiss watch, is a question that I will leave to philosophers. We as a nation are committed to the principle of mass production; and while we may deplore the vanishing of the old craftsman, few will seriously suggest a return to the former order.

But we do not stop with standardizing machine operations. We standardize also the operations of men. The motion study expert tells us that practically every man wastes a large percentage of his time and effort in even the simplest operation—that a dozen skilled mechanics will do the same thing in a dozen different ways, all of them wrong. So the motion study expert determines the one best way to do a job, and in one case after another we find that by following his method we not only increase production but we decrease fatigue. While so-called "efficiency engineering," like other pioneer movements, has suffered from the pretensions of quacks, there can be no serious question that modern industry demands the elimination of lost motion and the standardization, so far as is practicable, of every job in the plant.

If this is true, as it is true, I do not believe that anyone will question the next proposition that I want to make—that anything which interferes with this absolute regularity of operation is inefficient and uneconomical, and that it is one of the chief functions of the engineer and the executive to hunt out these disturbing influences and eliminate them.

The things which thus interfere with regular production are many and varied. Some of them are external to the plant itself—such as a war, or a nation-wide strike, or a railroad tieup. The prevention of these is largely a function of government, and the American people will not long tolerate conditions that permit such national inefficiencies.

Then there are catastrophes within the plant: A strike; a disabling fire; a break-down in the power plant. Everyone knows that it is the function of management to prevent such occurrences and that a management which does not in general prevent them cannot be permanently successful.

Then there is a third group of apparently minor disturbances. A laborer pushing a truck strikes an uneven place in the floor and a casting falls off the top of the load. The casting is heavy and he goes for help to put it on again. Meanwhile the lathe operator is waiting for the casting. The blockade of the passageway stops another truck coming up with material for another operator, who must also wait. The total loss of time may not be more than four minutes for each of five men—twenty minutes in all or, say, twenty-five cents' worth of time.

What does the foreman do when he finds that the lathe operator is waiting for material? If he is a foreman of the old school, he goes back and bawls out the "blankety blank wop" for running his truck into a hole in the floor. The man, thus admonished, is henceforth more careful—that is, he is slower in his movements. He takes pains to avoid the holes in the floor, the posts in dark passageway, the other various sundry obstructions which sprinkle his pathway. A little later the foreman is surprised and grieved to find that he must put on another man to help the truckers because they cannot keep up. He discourses feelingly and eloquently with the Assistant Superintendent on the total depravity of laborers in general and of his laborers in particular. Am I exaggerating? Not very much. How many of *us* carefully walk around a hole in the floor, or a slippery place, ten times a day, because it would take a little mental and physical energy to fix it up?

Of course, the foreman who is really on to his job has the floor fixed at once. If he is unusually intelligent, he also looks around for other things which interfere with efficient trucking. He may find that the lighting in the passageway is poor, and recommend to the Superintendent that it be improved. He may find that the truck itself can be slightly changed so as to make it less likely that anything will fall off. The up-to-date foreman realizes that when his laborers each lose twenty-five cents worth of time a day it is up to him, not to bawl them out for it, but to find out what is wrong and correct it. And it is up to the Superintendent and higher executive officers to supply what the foreman lacks in this regard. Once labor was the cheapest part of the cost—but the dollar-a-day man is gone.

In machine operations it is even more obvious that regularity is the essence of modern production. I dare say that every punch press foreman or superintendent in the United States has as his idea of heaven a place where—if punch presses are tolerated at all—not one of them ever misses a single stroke! Unfortunately this kind of heaven, like other kinds, is seldom met with on earth. I know of large and successful companies where punch press production is from 25 to 50 per cent less than perfect—that is, where only half or three-quarters of the strokes are productive, simply because proper means are not provided for placing the material in the press and taking it out again. The important point is that the greater part of this loss is positively preventable through the use of simple and inexpensive automatic or semi-automatic devices for placing and removing the material. Those of you who heard the remarkable account given this afternoon by Mr. Kaems of the Simmons Company, of simple methods by which punch press production was increased anywhere from 25 to 100 per cent, know that I am understating rather than overstating the fact. If such improvement is possible in a shop where the management was already on a basis of general high efficiency, what apparent miracles may not be expected elsewhere? The fact is that, with comparatively few exceptions, even in the most efficient plants, we have not had time to study these little things—the castings falling off the truck, the material sticking to the punch press,—causing in each individual case a loss of time reckoned only in seconds or minutes, but causing in the aggregate a loss running undoubtedly into many millions of hours and many millions of dollars. In the past, so vast were our resources that we could overlook these "small" losses, just as the city of Chicago pumps millions of gallons of water that are wasted through leaky pipes. But now the time has come, with our diminishing man power, diminishing natural resources, and prospective sharp competition from abroad, when we must meter and stop these leaks if we are to maintain our volume of production and our economic place in the front rank of the nations. I have tried thus far to make the point that modern production is built absolutely on standardized regularity of operation and that anything that interferes with regularity interferes with production. It is putting the same thought into other words to say that it is our constant effort to find the one best way of doing things and then always to do them in that way; and that anything which happens unexpectedly, whether it is a coal strike or a casting falling off the truck, is bound to interfere with our regular program and therefore to cut down our production. Therefore it is interesting to observe that the Standard Dictionary under the word "accident" gives as its first definition this: "Anything happening unexpectedly." In a second definition the dictionary recognizes, of course, the common usage of the word "accident" as meaning an occurrence in which someone is hurt. But in the broader meaning it is plain that, from the standpoint of industry, a coal strike is unexpected and is therefore an accident; a breakdown of the power plant is unexpected and is therefore an accident; the sticking of material in a punch press is unexpected—not contemplated or desired by the designer of the machine—and is therefore an accident, whether anyone happens to be injured or not. In short, "accident" in the broad meaning given it by the dictionary is exactly synonymous with all the disturbing things which interfere with production—it is the exact opposite of production efficiency. It stands precisely for all those things which we as engineers and executives must fight unceasingly. Now I come at last to the point where Safety enters into the proposition. Some of the "accidents" which I have mentioned—some of the things which happen unexpectedly—result in personal injury. From the standpoint of the man interested only in production, the accidents which happen to injure someone are no more and no less important than those which do not. It is true that from other standpoints the accidents causing personal injury are much more important. To the Legal Department, they mean the payment of compensation. To the Employment Department, they mean the necessity of providing another man. To any man with a spark of human feeling in his heart they mean pain and suffering to a fellow human being, perhaps poverty and distress to his dependents. But leaving these considerations out of account, considering ourselves as absolutely non-human engineers or executives and with an abundant supply of skilled labor and no compensation laws to worry acbout, even then we must recognize that at the very least the accident which injures someone is no less important than the accident which does not injure anyone, and all these accidents—all of these things happening unexpectedly—interfere with the regularity of our operation, and cut down our production. No engineer or executive living can afford to say "I am not interested in accident prevention" unless he is willing to say "I am not interested in efficiency"—because accidents and efficiency are absolutely incompatible; they cannot exist in the same plant; the plant where things are permitted to happen unexpectedly is an inefficient plant. Every accident is an indication that there is something wrong with men, methods, equipment, or material.

And if the engineer or executive must then be interested in all accidents, whether they cause injury or not, those which do cause injury have for him a peculiar importance, because they stand out conspicuously and serve as danger signals to warn him of the inefficiency that is undermining his output. This is not theory but fact. The improvements in punch press operation, which I have already mentioned, were suggested and carried out—by whom? By the production department or by some imported efficiency engineer? No—by the safety man! He found that men were losing fingers in these punch presses because they had to reach into the press to place or remove material. He changed the method of operation by introducing automatic or semi-automatic feeds and kickouts. He did this primarily to prevent the loss of fingers. Having done it, he found that he had increased production from 25 to 100 per cent. The foremen were astonished. They need not have been astonished. Reflection would have shown them that the movement of the operator in reaching into the press, while it occasionally caused the loss of a finger, always caused the loss of time; and that an arrangement which would save the occasional finger would also save a fraction of a second every time the machine was operated. To quote another instance of a more general nature, the manager of one of the largest paper mills included in the membership of the National Safety Council once said to me, "Before we had a safety committee, every little while we would have to shut down our machine because of a belt breaking or something of that sort. Now our safety inspection catches these things before they happen and we have no more shut-downs. Our safety work has more than paid for itself through the increase in production, aside from cutting down our compensation costs."

You may say, "These plants were not run efficiently. If they had been, it wouldn't have taken a safety man to show them how to feed punch presses or keep belts in repair." I freely grant this. Yet the fact remains that both of the plants which I have mentioned were and are in the very front rank of their industries, they were well managed, they were making money. The management simply, like every other management that I know of, was so busy with development and with the outstanding problems which it had to face that it could not watch every single detail.

In another instance, even more noteworthy than those I have mentioned, the Chief Engineer of a large company conceived an entirely new method of accomplishing an important process in the industry—a method wholly mechanical, to replace one which required constant attention by skilled men. It happened that these men were exposed to injurious dust. When the new plan was presented, it was opposed by some of the experienced factory executives who declared on general principles their firm conviction that it would not work. The President of the company said, "Even if the new method does not increase production as we hope it will, it will at least remove this danger to the health of our men. Therefore we will try it out." It was tried out. It worked. It cut down the number of attendants required from 23 to 3 and removed all hazards to those that remained. It increased production so tremendously that it will undoubtedly revolutionize the entire industry. This two-fold result was not a coincidence. It was a natural result of the fact that the old process was wasteful in both materials and time. The injurious dust that should have gone through the manufacturing process was blown out into the faces of the men. The new method saved both the dust and the men.

The man who did this remarkable piece of work was not a "safety engineer." He was an engineer who believed in safety. As a man, he believed in safety as a human necessity. As an engineer, he believed in safety as a thing inseparably bound up with engineering efficiency.

On the human value of safety, I leave each of you to judge for himself. I know how I feel and I think I know how you feel. But that is not my topic tonight but on safety as an engineering job. I know that the engineer whom I have mentioned, and the safety man in the punch press shop, and the paper mill manager, are right —I know that safety and engineering efficiency are inseparable. You cannot have one without the other. If you are safety men, think you have to put on a guard that interferes with production, you may be sure that your remedy is only a temporary one and that it must give way eventually to an improved machine or method which will be safe without being inefficient. And the engineer or executive who thinks that accident prevention is not in his department—that he will leave that to the safety man or the insurance company or the state inspector—is missing something—something big. He will find out some day that every accident in his plant or on the machine which he designed is a danger signal for him—a symptom of time and dollars wasted as well as lives and limbs. The rough shod methods of American industry a generation ago, which left a trail of human wreckage, were not only inhuman—they were inefficient. They and the men who stood for them are gone on the scrap heap, and will never return.

Recent Developments in Railway Water Supply

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Presented April 29, 1920.

THE estimated annual consumption of water by the railroads of the United States is, in round numbers, 900,000,000,000 gal. The cost of furnishing this water, not including interest and depreciation charges, will average over 7 cents per thousand gallons, making a total annual expenditure of more than $63,000,000 for water. To supply this water it is necessary to maintain approximately 13,000 water stations for locomotive supply in addition to many connections for general service.

An analysis of the consumption of 15,622,000 gal. of water on a middle western railroad indicated that 23 per cent or 3,600,000,000 gal. was purchased from 232 city and private water works plants and 12,022,000,000 gal. pumped by 230 railroad pumping plants. A further analysis of the various uses of this water indicated that locomotives consumed 74 per cent or 11,560,280,000 gal.; washing and filling boilers at terminals used 12 per cent or 1,874,640,000 gal.; 5½ per cent or 859,210,000 gal. was required by stationary power plants and 8½ per cent or 1,327,870,000 gal. was used for sanitary and domestic purposes.

As an example of the increased consumption of water by railroads during the last quarter of a century, a compilation of figures showing the water consumed at a railroad terminal in Central Illinois may be cited. The amount used at this point in 1898 was 72,637,000 gal., while in 1908 it had increased to 144,163,000 gal. and in 1918 to 288,454,000 gal. According to these figures the consumption doubled every ten years. It may be said in passing that the consumption in 1918 was 79,000,000 less than that of 1914 because of a campaign against water waste. Except for this the amount used in 1918 would have been more than double that of 1908.

PUMPING EQUIPMENT

There has been a marked development in pumping equipment used in railway water stations within the past few years, not only in providing larger equipment to take care of the increased requirements for water, but in the type of pumping equipment and power units as well, the old steam plant, long considered most satisfactory because of its adaptability to the varying conditions found in railway water service and its ease of operation with unskilled labor, giving way to more modern equipment. The gasoline engine was a popular unit for railway pumping stations as well as in the general industrial field for a time, but it was really never a serious competitor of steam except at the smaller stations and other points where the cost of pumping with coal as fuel was excessive.

Electricity has become available in many communities at rates sufficiently attractive to warrant serious consideration, with the result that there has been considerable use of electric motor drive for pumping plants at water stations. Two factors have been responsible for this development. One is the increased number of points where electric power is available; the other is the economies which may be effected by the substitution of electric motors for steam and gasoline engines, especially when the motors can be operated by automatic control, thereby eliminating the expense for constant attendance.

The motor-driven pumping plant with float switch control is especially suited to locomotive water tank service because the tank is kept full, regardless of variations in the demand for water, without any attention other than a periodical inspection of motor, control and pump. It is also practical in some installations to have the station agent or other local employe start and stop the pump motor by means of a remote control push button. The standard equipment now on the market is reliable and can be depended upon for pumping station service.

One middle western railroad has recently installed electric pumping equipment consisting of duplicate units each having a capacity of 1,000,000 gal. a per day, the operation of pumps being entirely controlled by the height of the water in the tanks. The former steam plant required the attention of three men while the electric plant is operated by one; the cost for current is about equal to the cost of coal formerly used in the operation of the steam plant; the net saving is $1,500 per year.

Oil engines of the so-called semi-diesel type are being used extensively in railway water service and are proving very economical and satisfactory power units. Oil engines operating on the lower grades of oil have been perfected to such an extent that their operation is practically as reliable as steam, although they are not as flexible when used with triplex and other positive displacement pumps. Failure to consider this feature has resulted in a few unsatisfactory installations. Oil engines have gained in favor as the centrifugal pump has been developed, as an oil engine and centrifugal pump make an ideal pumping unit. As an example of the increased use of oil engines one of the largest manufacturers of this type of power unit in the United States sold 495 oil engines to railroads in the five years ending January 1, 1919. These engines represent a total of 9,827 horsepower, 451 of them being 25 horse power and under. Of this equipment the total horse power sold in 1918 was 4,125 or 42 per cent of the total business of the previous four years, an increase over the average for the four years of about 290 per cent. As an example of what may be accomplished by installing an oil engine, a plant consisting of two 25 h. p. engines driving centrifugal pumps with an additional 100,000 gal. storage has dispensed with two pumpers at an annual saving of $1,800 in labor alone, besides a considerable reduction in the cost of fuel.

The use of oil engines and electricity has encouraged the further development of centrifugal and power pumps for use in connection with these power units and has resulted in a decided improvement in the efficiency of these pumps, this being especially true of the centrifugal pump. The cost for fuel will, of course, vary in different localities, but there is scarcely any place in the country where oil will not compare favorably with coal in the operating costs of a pumping plant. The economy of an electrical installation will, of course, depend upon the rate paid for electricity and the economy effected by decreased attendance.

An interesting feature in connection with recent water station construction is the growing tendency to install duplicate pumping units. While this, of course, increases the cost of construction, it is not difficult to justify the additional expenditure by uninterrupted service and reduced maintenance.

STORAGE.

Storage is an important feature of railway water service, but unfortunately it is a detail that has been much neglected in the past. Up to within the past few years the standard roadside tanks rarely exceeded 50,000 to 60,000 gal., although the standard roadside tanks today include those with a capacity of from 100,000 to 200,000 gal.

The necessity for greater storage is more evident at this time than ever before on account of shorter hours of service and the increased wages of pumpers. The purpose of a water tank is to provide storage for a volume of water that will be ample for all requirements at a head sufficient to deliver the water in adequate quantity at the points required. The size and capacity of the tank and the height of the tower will be governed entirely by these two requirements. For example, if the delivery to the tank is constant, as from a city supply, and the demand fairly uniform, the size of tank may be nominal, but if the delivery or demand is irregular the capacity of the tank should be great enough to carry over the period when water is not being delivered to it and to take care of the maximum consumption.

The amount of storage available is an important factor in the operation of a railway pumping station, as the expense for operation may easily be doubled through the necessity for employment of additional pumpers by reason of the tank being too small to carry over the night hours, notwithstanding the fact that the equipment may be large enough to pump all of the water required during the day shift.

Tanks now in use and adapted for use in railway water service comprise practically every type of tank constructed. Most of the tanks of the past have been constructed of timber, and while other materials are being used there is no question but that timber will continue to enter into the construction of tanks to a large extent. The comparative life and value of wood and steel tanks have been the subject of much discussion, each type of tank having its more or less disinterested champions. Unfortunately much of the discussion has consisted of individual opinion or the citing of an obscure example of what might be expected of each type of tank. With the increased scarcity of suitable timber for the construction of wooden tanks, steel has become a very strong competitor, particularly in the standard tanks of 100,000 gal. capacity. Previous to the great increase in cost of steel and the restrictions placed on the railroads, prohibiting the use of steel for water tanks during the war, steel tanks were largely supplanting the wood tanks. Conditions growing out of the war, however, have compelled the railroads to again consider the wooden tank.

One important development along this line has been the use of treated timber for the construction of tanks. On certain railroads favorably situated the creosoted tank has proved a very profitable investment, as the first cost of construction has been much less than either an untreated tank or more permanent timber or the steel tank. While these tanks of treated timber have not been in service long enough to determine their useful life, there is every reason to believe that their life will be as great as that of the best untreated timber, and the maintenance of a treated tank properly framed before treatment much less than either the untreated timber tank or the steel tank.

One decided advantage possessed by the modern conical bottom or hemispherical steel tank over the wooden tank or flat bottom steel tank is the removal of suspended matter carried by the water, through precipitation. There is a great need for a simple type of settling basin or filter for use in connection with the wood tank, as the removal of the suspended matter from water supplied from streams before it enters the locomotives will effect material economies in boiler repairs and washouts.

WATER TREATMENT

There has probably never been a time when more interest has been displayed in the treatment of locomotive water supplies than within the past two or three years, the reason being, of course, due to the greatly increased cost of fuel and boiler repairs and the importance of keeping locomotives in service. It is only too true that the treatment of locomotive boiler supplies has been neglected as may readily be seen by comparing the amount of water treated with that requiring treatment. While there is no complete record of the number of water treating plants in service on the railroads of the country, a fairly accurate estimate would be in the neighborhood of 600 plants, and from the known capacity of some 200 plants the average amount treated by each plant is 36,000,000 gal. per year, making approximately 21,600,000,000 gal. of treated water used annually on railroads.

Assuming that 80 per cent of the total consumption, or 720,000,000,000 gal. of water is used by locomotives and power plants, and that 50 per cent is of such quality that treatment would be economical, it means that we have less than 6 per cent of the treating plants in service that are needed. It is only necessary to check the reports of the results obtained from treating plants on those roads having them in service to be convinced that there are few investments that can be made on a railroad that will show quicker or greater returns than a properly designed and operated water softening plant.

The report of the results obtained on the Missouri Pacific for 1918 shows that 1,368,305,000 gal. of water were treated, removing from this water 3,589,473 lbs. of scale forming matter, effecting a net saving of $279,843, these results being accomplished through 52 water treating plants, the majority of which are in the hard water district in the plains west of Kansas City. Another instance is the excellent results obtained from the treatment of water on the Great Northern with 77 plants in service, where the saving in fuel, boiler repairs and engine time have fully justified the expenditure for construction and operation of these plants.

Still another example of what may be accomplished by properly treating water is given in a report on the results obtained with a plant treating water for equipment used on railroad construction, the water being used in the boilers of two steam shovels, six locomotives and two hoisting engines. In this particular instance the results are conclusive because the equipment was limited to a supply of water from a single source, the final conclusion being based upon the results obtained from the use of the water before and after treatment. Briefly, the saving of the entire cost of the water softening plant was accomplished in less than two months. The cost of coal used per cubic yard of earth handled was $.0306 with the untreated water and $.0204 with the treated water, a reduction of 33 per cent.

The United States Fuel Administration stated in its Engineering Bulletin No. 3 that it has been estimated that the use of hard water in a great number of the locomotive boilers of the country involved the consumption of 15,000,000 tons of coal more than would be needed if soft water only was used.

There is no lack of data on the benefits to be derived from treatment of water nor apparently is there a lack of appreciation of the importance of water treatment. The fact that a larger percentage of the water conditions are not improved may be due to the fact that there is not a centralized responsibility for the quality of the water.

WATER WASTE.

The Illinois Central has been making a campaign against water waste for the past five years, with the result that the saving during this period has amounted to $326,900, an average annual saving of $65,380, or nearly $200 per day. This saving has been accomplished by investigating every possible source of waste and keeping the importance of the subject constantly before officer and employe. The principal saving was made in the cost of city water and efforts were directed chiefly toward correcting the waste of water purchased from outside parties, as the cost of water purchased is generally higher than that pumped by company forces;

however, large reductions were also made in the consumption of company water as well as city water.

In order to keep a check upon the water purchased all bills are entered on a card index for the purpose of comparing cost and consumption. Any increased consumption is noted and called to the attention of the officer having jurisdiction over the water at that particular point. If a satisfactory explanation cannot be given an investigation is made, which invariably results in disclosing and correcting the waste.

While many instances of conditions found and corrected in these water waste surveys might be recounted, it is probable that there are few water services on the average railroad where a saving cannot be effected in water consumption. While large wastes such as overflowing tenders and tanks, bursted mains, etc., are important, as a general thing they are easily corrected as the loss is very apparent. It is usually the smaller leaks such as occur at slop sinks, wash basins, toilets, urinals and other fixtures connected direct to sewers and drains that cause the greatest waste and are the most difficult to correct because of the apparent insignificance of the loss and hidden nature of the waste.

As an example of the quantity of water that may be wasted through small openings, a 1/16-inch stream, such as may be caused by a worn faucet washer, will, at 40 lb. pressure, waste 18,844 gal. per month, which at 20 cts. per thousand gallons will amount to $3.68, or enough to purchase a new faucet, while a ¼-inch stream such as an overflowing toilet flush, will waste 301,500 gal. per month at a cost of $60.30, or enough to install a first class toilet complete.

It is not surprising that water waste occurs on our railroads when one considers that the daily consumption is nearly two and one-half billion gallons, delivered through innumerable connections and under the control of thousands of employes, the greatest number of whom have no conception of the value of water. The fact that waste does occur is generally accepted, but it is a mistake to assume that the waste cannot be corrected or that correcting an occasional waste here and there solves the problem, as it is only by continued effort that maximum results are to be obtained.

ORGANIZATION.

There has been a marked change in the general attitude towards railroad water service in recent years. Water supply was formerly merely an incident in railway operation, any supply most convenient was used and little consideration was given to the quality or the cost of producing the water. As the importance of this branch of railway operation was recognized, and the need for more and better water increased with the development of transportation, the various features pertaining to water supply have been given more attention. This increased interest has been directed to some extent towards providing an organization for properly handling the various problems concerned in the development, construction, operation and maintenance of water supply.

The general idea prevailing as to a water service organization is usually associated with the construction of water facilities rather than with the maintenance and operation. While the development of water supplies and the proper design and construction of water facilities demands careful study, operation and maintenance are of equal importance, and continued trained supervision is necessary if economical results are to be obtained.

Providing water for locomotives and for other railway purposes is a feature of railway operation that is subject to more variation than the practices of any other department. While several railroads have recently established Water Departments, others still retain the old organization whereby the development, design and construction is handled by someone in the Engineering Department in connection with other duties, while the maintenance and operation of water stations is handled by the Supervisor or Foreman of Bridges and Buildings as a part of his duties. The development of an adequate water supply, the economical and efficient design and construction of water stations, together with efficient supervision over maintenance and operation, are problems that require the undivided attention of a staff trained in water service work. The problems connected with water supply can best be solved with a separate organization charged with the sole responsibility for their successful operation. On most railroads the nucleus of a water department organization already exists, and the establishing of an individual department would not necessarily mean that there would be any material change in the division or local forces, but rather that the local officers and the engineering department would be relieved of the duties incident to the design, development and operation of water facilities, and the work placed under the direction of those trained along this particular line. The results obtained by roads that have established a water department, have shown conclusively that there is an urgent necessity for an organization to handle this very important feature of railroad operation.

DISCUSSION

(Of Paper read by Mr. C. R. Knowles, Supt. Water Service, Ill. Central R. R., on Water Service on American Railroads, before the Railway Engineering Section of the Western Society of Engineers, Apr. 29, 1920.)

Water can be roughly divided into three varieties, that containing very little foreign matter which we find in the East, hard water found in the Middle West, and hard water containing alkali found west of the Missouri River and in the Southwest.

In the Eastern territory boiler flues will last fifteen or twenty years with little attention. In the alkali belt they will last often only a few months. In other areas they vary between these two.

Hardness in water is caused by the presence usually of carbonates and sulphates, of lime, and magnesia. The carbonates are found in what is generally known as limestone country. The sulphates are found in most arid territory. In the latter also we have the alkali salts.

The carbonates are found in water in solution with carbonic acid which forms a bi-carbonate. This is readily removed and the soft scale-forming matter precipitated by the use of lime as a reagent.

The sulphates, or hard scale-forming matter, are removed by the use of soda ash. This puts sodium sulphate in the water and is not practicable when the sodium salts are already so high as to cause foaming.

In 1870 the Master Mechanics' Association began studying this subject and the study has increased as the railroads advanced into the western territory. In addition to this scale-forming matter in the water another trouble was experienced—pitting. This was so bad that in places flues only lasted a couple of months. For a long time this was thought to be produced by carbonic acid, which would be removed by treating with lime. This was found not to be the case; although treatment decreased the trouble, it did not cure it in all cases.

Latest research shows that it is caused by electric action. Current moving out of steel pits it. The quality of the water when it produces low potential the electromotive force causes the current to flow towards the water and produces pitting.

It has been eliminated, in locomotive practice, on one railroad by the addition of caustic soda.

In the treatment of water another difficulty has been met with. known as "after-precipitation." This is due to the small quantity of lime left in the treated water. Lime is precipitated when the temperature rises. Hence a few grains per gallon will deposit when the water is heated, either in feed water heaters or injectors. The trouble will be greatest in winter.

The trouble with after-precipitation can be cured by using about 3 grs. per gallon of sulphate of iron, after the treatment in the regular manner has been concluded.

The types of treating plants now in use are some variation of the Porter-Clarke, or lime and soda ash. There are no zerlite softeners for locomotive feed water now in use.

Steel tanks are apparently the best for water in most territories, but the trouble experienced with pitting in western territory has caused the opinion to be expressed that in such territory the wooden tanks will last longer. Some railroads are now using creosoted wood.

The supervision of water treatment has not advanced as rapidly as the science itself. A few roads now maintain a water service department in which all matters are handled which pertain to the subject. As now organized most railroads handle the operating side of the question through a roadway official such as division engineer or roadmaster. The design of plants is frequently left to the engineering department without special knowledge of the subject of water supply.

One advantage of a separate water service organization is its ability to follow all the phases of the subject—the question of the quantity, quality and disposition made of the water. Treating plants must have very close supervision, also there must be a constant effort to eliminate waste. Water is money and not as free as air, as many seem to believe.

The chemical testing of water must be done at the site of the treating plant and such changes made as are required at that time. Sending samples to a central laboratory and waiting for the return of directions is not good practice, as the chemical content of the water has changed in the meantime.

A diversity of opinion is found on the subject of filters for treating plants. Some prefer them as they regard them as a check on the water treatment. The use of sulphate of iron in the opinion of others eliminates the necessity.

To be effective, the water service should be handled as a separate department and the matter handled intensively from the design of the plants to the final use without division of responsibility.

CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY *of* ENGINEERS

Volume XXV NOVEMBER, 1920 Number 15

Information for Engineers

The fact that many of the engineers engaged in water-supply, sewerage, and other sanitary work in this State do not make use of the information available in the Division of Engineering and Sanitation of the State Department of Public Health is probably due to the fact that they are not aware that such information and assistance are available, although in the Sanitary Engineering number of the Illinois Health News for August, 1916, the activities of the Division and the information and assistance which the Division was able to render engineers and public officials were described in detail. The large amount of work in connection with improvements or enlargements of existing water-supply and sewer systems and the installation of new water-supply and sewer systems that is now under way or is proposed or should be carried out in State makes it desirable that attention again be called to the information and assistance that the Division of Engineering and Sanitation will furnish to engineers or public officials.

The activities of the Division of Engineering and Sanitation are the same as noted in the Health News for August, 1916, and may be enumerated as follows:

(1) Control of installation of water-supply and sewer systems, including water-purification plants and sewage-treatment plants. Examination and approval of plans for all such installations.
(2) Studies of stream pollution.
(3) Sanitary surveys.
(4) Supervision over sanitation of common carriers including sources and handling of water supplies.
(5) Sanitary inspections of public school buildings.
(6) Malaria control by mosquito eradication.
(7) Studies of city waste collection and disposal and street cleaning.
(8) Investigations of typhoid fever and other diseases that may be water-borne.
(9) Public addresses on sanitary engineering topics.
(10) Informal advice by correspondence on sanitary matters.

Because of the limited staff it has not been possible to carry on some of the activities enumerated as thoroughly as would be desirable, but special attention has been given to water-supply and sewerage work, which work is perhaps of the more importance to engineers. Moreover, it is considered that the installation of good public water-supply and sewer systems will do more to improve health conditions than any other public improvement that can be undertaken.

Examinations have been made of nearly all existing public water-supply and sewer systems, including water-purification and sewage-treatment plants, in the State. Preliminary investigations and studies have also been made in many communities where water-supply and sewer systems should be installed or improved. Detailed descriptive reports have been prepared of all of these investigations, as well as reports on the other activities of the Division. All of these reports and other information gathered by the Division are available for public use and any engineer contemplating or doing work in connection with which these reports or information would be valuable, can consult them at the offices of the Division at Springfield. If an engineer has been actually engaged by a community, copies of reports previously prepared by the Division can often be furnished.

In addition to the assistance that engineers may derive from reports and data collected by the Division, additional investigations can be made in co-operation with engineers that have been engaged by communities to make studies or prepare plans and specifications for public improvements. In this way the Division does not attempt to take the place of a consulting engineer, but, on the other hand, always encourages the employment of competent consulting engineers by communities and then endeavor to assist the engineer insofar as its authority and duties will permit. Experience has shown that this service has been very beneficial to engineers and communities, especially in connection with preliminary studies of proposed water-supply and sewer systems.

In connection with the activities of the Division relating to control over the installation or improvements of water-supply and sewer systems, it is required that plans and specifications for such improvements be submitted and receive written approval. Experience has shown that this activity has been beneficial to engineers because communities, as a rule, are more favorable to the installation of public improvements which they sometimes consider very costly when they are assured that the improvement has been carefully studied and that the plans and specifications have the approval of a State department which is in a position to examine all such improvements in the State and note their character and efficiency. Moreover, when plans have received the approval of the Division and for some reason or other the community loses interest or delays action, the Division can often be helpful in properly presenting the project to the community and having definite action taken.

Plans and specifications submitted by engineers for proposed projects are not open to the public. If, however, an engineer has been engaged by a community, then plans of existing works that may have been filed with the Division are available for review by the engineer so engaged.

The Division has adopted the practice of recommending to communities the employment of competent engineers, experienced in water-supply and sewerage work whenever such work is contemplated, but does not suggest names of engineers or engineering firms even when so requested by municipal officials. The Division will furnish engineers on request, information relative to any particular municipality, where water-supply or sewerage or other sanitary work is needed, but does not furnish a general list of places where such improvements are being considered or should be carried out.

It is believed that since the creation of the Division of Engineering and Sanitation that there has been an improvement in the attitude of public officials toward retaining engineers in connection with proposed work. Every effort is made to have municipalities engage competent engineers, when a project is first considered, to make studies and prepare preliminary reports with estimates of cost, and make definite recommendations rather than to have the city officials decide, without having sufficient data before them, what they consider should be done and then engage engineers only to design and carry out the work which the city has already decided upon. There have been several instances where communities were going to undertake work without proper engineering assistance and which work would have been of poor quality if the need of proper engineering assistance had not been pointed out by the Division. It is, therefore, felt that the activities of the Division are not only of service and importance to communities but are of marked value to practicing engineers, and it is, therefore, desired that the engineers who are not now making use of the information and assistance of the Division be made aware that such information and assistance are available and at their disposition.

C. ST. CLAIR DRAKE, M. D.,
Director for Public Health for Illinois.
HARRY F. FERGUSON,
Chief Sanitary Engineer.

Proposed Bill Approved By Executives

The national executive committee of the American Association of Engineers has approved the proposed bill for licensing engineers, architects and surveyors in Ohio, as proposed by Cecil L. Rood, president of the Ohio Engineering Society and the Ohio Association of Technical Societies and approved by the Ohio Assembly of A. A. E.

Changes in the American Engineering Standards Committee

The United States Department of Agriculture recently became a member of the American Engineering Standards Committee. This committee is an organization originally made up of three members from each of the five founder engineering societies—American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Mining Engineers, American Institute of Electrical Engineers, and the American Society for Testing Materials. The committee was later enlarged to take in three representatives each from the Army, the Navy, and the Department of Commerce. More recently organizations dealing with safety codes and with fire protection have been admitted to membership on the committee. The purpose of the American Engineering Standards Committee is to bring about the adoption of uniform and satisfactory standards in engineering work.

SECRETARY APPOINTS REPRESENTATIVES

The department is entitled to three representatives on the committee, and the Secretary of Agriculture has appointed one from the Bureau of Chemistry, one from the Bureau of Public Roads, and one from the Forest Service.

The Bureau of Chemistry is interested in specifications and standards for a variety of materials including leather, paper, naval stores, dye, fiber products, vegetables and animal oils, etc. The Bureau from time to time has prepared various specifications and methods of grading such materials based on results of extensive investigations.

The Bureau of Public Roads has done work on the standardization of specifications for road materials. It has had large experience in road work and has excellent facilities for observing the wearing qualities of various kinds of roads built under the direction of the bureau and otherwise.

The Forest Service has taken part in the establishment of standards for forest products of various kinds for over 20 years, including the establishment of names for trees and woods, strength values, form of construction, specifications, grading rules, etc. The Forest Products Laboratory of the Forest Service at Madison, Wis., has for a number of years conducted extensive tests and investigations of forest products and assisted in the preparation of standards and specifications covering the use of wood in engineering construction.

WILL AID WORK MATERIALLY

The opportunity for bringing about increased efficiency in the use of engineering materials through the general adoption of carefully considered specifications is very large. The representatives of the Department of Agriculture who are members of the committee will be able to materially assist in furthering the work of the committee when dealing with the large variety of materials on which the department has conducted extensive tests and investigations.

The first meetings of the committee which the department representatives attended was held in New York, October 9. The representatives of the department appointed by the Secretary are: A. T. Goldbeck, Bureau of Public Roads; D. J. Price, Bureau of Chemistry, and E. H. Clapp, Forest Service.

RECEPTION COMMITTEE

J. E. LOVE, Chairman.

"Only Once a Stranger."

This is the secret slogan of the Reception Committee,—first because neither the Committee or the Society knows of this slogan. Apparently this is not the only secret part of the Reception Committee, for its accomplishments, its meetings and its membership are all practically unknown to the Society. The Chairman of the Committee is not allowed at the present time to develop any of the past workings of the Committee, but has procured permission to announce that the members shall from time to time appear at the Society Meetings to endeavor to fulfill the spirit of that slogan.

It is necessary at this time to issue a call for volunteers for additional workers. Several of the Committee members whose places of business are far from the Loop find it difficult to attend the Society meetings and then again some of the Sections have no representation on the Reception Committee.

Inasmuch as the work of the Committee, whether secret or open, is not exhausting, any member of the Society who is more or less of a regular attendant of his Section meetings is requested to send in his application for appointment to Mr. Nethercut.

Western Society of Engineers Noon Day Luncheon

Mr. Harry H. Merrick, President of the Great Lakes Trust Company, said that Bankers and Engineers were optimists, in discussing the subject "Where are we Heading?"

Mr. Merrick did not attempt to analyize conditions covering the entire world, but said that conditions in the United States were well known and that credits could be set up and given a value in this country.

Last December the industries were working to the limit and loading up with all kinds of manufactured material. This was in accordance with the advices from Washington and resulted in an excessive over-production.

The resources of the United States far exceed the liabilities; in fact, the value of the farm crops, exclusive of live stock, for the current year is in excess of our National debt.

What is needed at the present time is Leadership and the establishment of a fair policy so that industries may plan for the future. Taxation at the present time will discharge our National debt in seven years, which is quite a different policy from that adopted by foreign countries, who plan to liquidate their debt in from fifty to one hundred years.

The banks have been accused of shutting off credit and arbitrarily restricting production. The action of the banks in conserving our resources saved the country from a panic which was prophesied for April last. The crisis did not come, according to schedule.

Mr. Merrick quoted a statement made some years ago by former President Roosevelt to the effect that post-war problems were far more difficult than pre-war problems. He urged that all thinking men give attention to the present problems, among which the Railroad problem—transportation—is pre-eminent. Since the return of the Railroads to private control, most wonderful success has followed the efforts to increase transportation.

The labor problem is approaching a satisfactory solution. The efficiency of labor is all important and since the demand for labor has decreased in the present rearrangement, personal efficiency is being restored.

In order to have sufficient production and the proper supply for our domestic needs, consideration should be given to foreign commerce and such regulation as will restrict export to a point that domestic demands can be supplied, should be undertaken.

Mr. Merrick's address was inspiring and very opportune.

The noon-day luncheon was attended by three hundred and was very representative of the new element in the Society, as well as those who have been active in past years. Mr. J. H. Liberton, Chairman of the Noon-Day Luncheon Committee, presided and introduced Mr. Merrick.

A. S. M. E. Organizes Materials Handling Section

Four hundred members of The American Society of Mechanical Engineers have organized themselves into a Professional Section on Materials Handling and will provide primarily a common channel of intercourse between all the technical and industrial organizations co-operating in the solution of engineering problems connected with the handling and distribution of materials and products.

Probably the greatest economic need of civilization today is the devising of means and a more intelligent application of proper and co-ordinated methods whereby materials of one kind or another may be handled more swiftly and to better advantage.

Industrial and railroad congestion has been almost intolerable and with these continued conditions have come mounting costs until better, more efficient and more adequate systems must come into being if the cost differential that is now being reflected in the soaring prices of all goods is to be modified.

The burden of this necessity made it imperative that a professional section composed of those whose interests and whose expert knowledge brings this problem close to them, should assume this work as its obligation to the technical fraternity and its contribution toward the solution of our national economic problem.

This Section will aim to be a bureau of information—complete in its scope, specific in its knowledge of the physical and economic conditions and unbiased in its conclusions. This will be done by having special meetings on particular subjects, meetings jointly with other sections, other organizations or associations, by taking part in all local and national problems relating to the purpose of this Section.

American Society Municipal Improvements to Consider Pavement Repair Methods

One of the important problems to be discussed at the Convention of the American Society for Municipal Improvements, St. Louis, October 12-15, will be the condition of city pavements throughout the United States following the four years of neglect during the War. It has been stated by prominent authorities that over $100,000,000 in city pavements have been ruined by the failure to keep up paving repairs during the time that all energies were devoted to war industries. The Municipal Engineers now face the problem of bringing these pavements back into service with the least expenditure.

Candidates for A. S. C. E.—Officers Are Named

The American Society of Civil Engineers has just announced the Nominating Committee's selection of Candidates for the offices to be filled at the annual election. George F. Webster of Philadelphia, Pa., heads the ticket for President.

Climate and the Dairy Barn

The Committee on Ventilation of Farm Buildings of the American Society of Agricultural Engineers is making a study of the proper housing conditions for stock in different parts of the United States and Canada.

As the cow is the source of heat in the dairy barn it follows that the construction and ventilations of the barn must be different in the northern part of the country, than in the southern to maintain the proper temperature and sanitary condition of the air.

An article under the head of "Climatic Dairy Barns" by W. B. Clarkson and C. S. Whitnah will be published in the October number of the Society's Journal "Agricultural Engineering."

The authors have divided the country into four well defined zones, based on sustained low temperature in the winter months, and outline the proper type of barn in its relation to the temperature of the different zones.

—From American Society of Agricultural Engineers.

National Safety Council

Of all the countries where the safety movement has gained sway, in America alone has it been the result of a democratic movement of both employers and employees, and the greater success which the movement has achieved in this country than in others is attributed to this fact by Charles P. Tolman, the new President of the National Safety Council, who was elected at the ninth Annual Safety Congress held in Milwaukee, September 27 to October 1. Mr. Tolman is Chief Engineer of the National Lead Company, New York City.

Other officers for the year elected at the Congress are:

First Vice President, W. H. Cameron, Secretary-Treasurer of the Workmen's Compensation Service Bureau, New York City.

Second Vice President, L. A. DeBlois, Manager of Safety Section, E. I. du Pont de Nemours & Co., Wilmington, Del.

Third Vice President, W. E. Worth, Assistant Manager, Industrial Relations Department, International Harvester Company, Chicago, Ill.

Fourth Vice President, John A. Oartel, Safety Engineer, Carnegie Steel Company, Pittsburgh, Pa.

The following officers of the staff at the National Headquarters in Chicago were re-elected:

C. W. Price, General Manager; Sidney J. Williams, Secretary; W. H. Frater, Treasurer; and R. T. Solensten, Assistant Secretary.

President Tolman's statement on the contrast between the safety movement in American and Europe follows:

"There is one thing which has impressed me as particularly an essential of the safety movement, and that is that it depends entirely upon a sense of individual responsibility.

"The safety movement in Europe was largely a matter of mechanical exhibitions and an autocratic enforcement of rules. It nevertheless did good. In England the safety movement was more paternalistic and a matter of enforcement of rules of hygiene as well as mechanical safeguarding. In America the safety movement is noticeably a democratic movement dealing, for the greater part, with the humane consideration and with the individual himself. The safety movement, which it has succeeded largely, has so succeeded because the individual was himself made to feel the responsibility both for himself and his fellow-workers."

Engineering Council

The October meeting of Engineering Council was held in Chicago, October 21st, 1920. Sessions of the Council were held in the rooms of the Western Society of Engineers, Mr. J. Park Channing presiding.

There were present as representatives of various societies the following:

Am. So. C. E.—C. S. Churchill, A. N. Talbot, Charles F. Loweth; alternates, Chas. L. Strobel, Edgar S. Nethercut. A. I. M. E.—J. Park Channing, P. N. Moore, Edwin Ludlow, F. T. Rubidge; alternate, H. L. Hollis. A. S. M. E.—alternates, Arthur L. Rice, F. K. Copeland. A. I. E. E.—Chas. F. Ruffner; alternates, F. F. Fowle, D. W. Roper. A. S. T. N.—C. D. Young. A. R. E. A.—alternate, A. S. Baldwin. Secretary, Alfred D. Flynn.

Progress reports were received on the following subjects:

Classification and Compensation of Engineers.
Water Conservation.
National Board for Jurisdictional Awards in Building Industry.
Military Affairs.
Co-operation with Architects.
Russian American Engineering Society.
Payment for Estimating.

The License Committee made an extensive report. Resolutions were adopted with regard to Nolan Bill now pending before Congress to offer relief in the Patent Office, as follows:

"RESOLVED: That the Engineering Council representing 40,000 engineers regards it of large importance that the numbers of the examining and clerical forces for the Patent Office and the salaries therefor in Nolan Patent Bill H. R. 11,984, be restored to those in the bill as it passed the House of Representatives; that the bill be freed from any riders, such as section 9 thereof, which may delay or jeopardize the passage thereof, and that the bill be made a law at the earliest possible moment.

"RESOLVED: That the Engineering Council, having on the 21st day of October, 1920, passed a resolution urging the restoration to their original values of the figures for the examining and clerical forces of the Patent Office and the salaries therefor in the Nolan Patent Office bill H. R. 11,984, recommends that the constituent engineering societies which it represents request their memberships to communicate with their representatives and senators in Congress, urging action in accordance with the said resolution."

The National Public Works Department was reported by Mr. M. O. Leighton, Washington representative. This report reviewed the situation with regard to the proposed legislation establishing a department of public works. This movement was started at a conference held in the Western Society rooms in April, 1919, and active efforts have been made to secure the necessary legislation. The bill is now pending before Congress known as Jones-Reeves Bill, will probably be reported by the committee the coming session of Congress. Mr. Leighton urged the active support of this bill by all engineers, especially by direct personal contact with Congressmen and Senators.

This department has carried on a very successful and satisfactory work in Washington and has kept closely in touch with all activities relating to and effecting engineers. Mr. Leighton, however, was quite right in urging the necessity of a more personal participation in legislation regarding engineers in order to effectually conclude the present needs for the profession.

LICENSE COMMITTEE: T. L. Condron, chairman, and Mr. F. C. Shenehon, members of the committee, reported a certain modification in the proposed Uniform License Law for Architects, Engineers and Land Surveyors. After considerable discussion it was the sense of the meeting that while Engineering Council did not recommend licensing of engineers, where laws were being considered by the various states they would recommend that such laws be drawn up to conform to the Uniform Law proposed by the License Committee.

The next meeting of Engineering Council will be in December. The Board of Direction of the American Railway Engineering Association were hosts at a luncheon to Engineering Council and representatives of visiting Societies at the Union League Club.

Engineering Council has, during its organization, accomplished very far reaching results, which is a great credit to the Member Societies and to the profession as a whole.

Agricultural Engineers Launch Journal

The initial number of "The Journal of the American Society of Agricultural Engineers" has just been printed by the Torch Press of Cedar Rapids, Iowa, and is being mailed at that point. It is 9 by 12 inches in size and is similar in make-up to the journals of other engineering societies. Among the leading articles are, "Standardization of Farm Equipment," by Raymond Olney, Chairman of the Standardization Committee of the society; "History of the Organization of the Society," by Prof. J. B. Davidson, Secretary; "Plantation Management from the Inside," by Stanley F. Morse, consulting agricultural engineer of New Orleans, Louisiana; "The Hardware Association and College Agricultural Engineers," by Herbert P. Sheets, Secretary-Treasurer of the National Retail Hardware Association.

The journal is to be issued monthly and it is planned that each issue shall give special prominence to some particular branch of agricultural engineering. The annual subscription price to non-members is $3.00. All business in connection with the journal is being handled through the office of the society's secretary at Ames, Iowa.

Steps to Raise Price of Rubber

A recent report from London states that, to raise the price of raw rubber, drastic steps are contemplated by the Rubber Growers Association, which represents about one-third of the owners of 3,000,000 acres of rubber plantations. The Association suggests to members that they so reduce tappings of rubber trees as to effect a reduction of 25% in the output.

Classification and Compensation for Engineers

It is doubtless known that engineers in all branches of the profession have suffered serious hardship during the past three years from the great decrease in buying power of the dollar. In few cases has their pay been increased sufficiently to offset any large proportion of the increased cost of living.

Engineering Council, which represents over 45,000 engineers in all parts of the United States, has had this matter under investigation for over a year. The standard classification of grading for engineering service, with a tentative schedule of standard rates of compensation in each of the proposed grades as contained in the report of the Council's special Committee on the Classification and Compensation of Engineers follows:

Adopted Grades	Compensation Schedule (Tentative)
Junior Aid	$1,080 to $1,560
Aid	1,680 to 2,400
Senior Aid	2,520 to 3,240
Junior Assist. Engineer	1,620 to 2,580
Assistant Engineer	2,700 to 4,140
Senior Assist. Engineer	4,320 to 5,760
Engineer	5,940 and upwards
Chief Engineer	8,100 and upwards

Engineering Council has approved this classification, and it is believed to be applicable to all branches of engineering service.

Happenings at Committee Meetings I Have Attended

(By Ozy Himself)

About one o'clock of October 8th, I was asked to sit in with the Executive Committee of the Telephone, Telegraph & Radio Section of which Mr. Fowle is Chairman. From the list of speakers mentioned and the variations of subjects, it appears to me that the meetings arranged under this section will be of utmost interest to nearly every member of the W. S. E.

Owing to the fact that their next meeting night fell on Election Day it was decided to change their meeting to November 4th, as it is the desire to have the full attention and an audience whose attention would be divided between Election Returns and the paper presented could not get the full benefit of the Paper.

As a suggestion—watch for the T. T. & R. Section Announcements. They will surely interest you.

Whether the meeting at lunch on October 13th, at which Messrs. Howsen, Rice, VanVliet and myself were present was a regular one, I do not know. But real action was taken regarding the advertising, and other policies of interest to the Journal.

To keep the Journal up to the highest point of appearance—to make it a standard in its class—to make the presentation of both reading matter and advertising interesting, the new forms, which have been made in this issue, are such that we hope you will notice and comment on.

Noted Irrigation Project Completed

Completion of the North Side Twin Falls Irrigation Project has been announced. This is one of the earliest and for a long time most discouraging projects in Idaho, which takes water from the Snake River. It is now one of the most prosperous of the Carey Act Enterprises, has been accepted as completed by the State and turned over to the settlers for management. Work of segregation began in 1906. Of the 170,000 acres involved 145,000 are not under cultivation. The canal system is 800 miles long and the total cost of construction is $4,500,000.00.

National Electrical Safety Code

The new edition of the National Electrical Safety Code is being printed by the Bureau of Standards. This code has been in the course of development for seven years. Preliminary drafts were circulated and criticized and the complete edition of the code was published in 1916 for trial use and constructive criticism. The new edition is expected to be made mandatory by state and city officials having appropriate jurisdiction. The rules of this code deal with the construction, installation and operation of electrical machinery and devices. They apply to practice in generating stations, to out-door lines used in transmission and distribution, and to the installations of equipment found in factories, offices, theatres and other places where electrical energy may be applied.

Personal

The appointment of T. W. Norcross of the Forest Service, effective October 10, is announced by Colonel W. B. Greeley, head of the Forest Service. Mr. Norcross succeeds O. C. Merrill, who resigned a short time ago to become Executive Secretary of the Federal Power Commission.

Ira O. Baker, Professor of Civil Engineering, University of Illinois, has been acting Head of the Civil Engineering Department of the University, succeeding Prof. Frederick H. Newell, recently resigned.

Herbert Hoover has been appointed a member of the advisory board for the Eastern Industrial Region Superpower Survey now being conducted by the Geological Survey. Mr. Hoover will serve as consulting mining engineer on the board, which is assisting the government in the development of plans for a vast superpower system stretching from Boston to Washington and designed to supply electrical power to railroads, public utilities and private industry throughout that territory.

C. Howard Crane, Elmer George Keihle and **Cyril E. Schley** announce the opening of an office at 127 N. Dearborn Street, Chicago, Ill. **H. Kenneth Franzum** is in charge.

C. Whitney Stevens, architect, 5257 Magnolia Avenue, Chicago, Ill., announces an office at 1113 Garrick Bldg., that city.

F. C. Walker, architect, 4712 Beacon Street, Chicago, Ill., has announced an office at 1846-72 West Adams Street, that city.

E. A. Brofas, who has been representing the Western Electric Company in Northern Europe for several years, has been appointed Manager of a new Norwegian Corporation to handle all of the Scandinavian business of the Internation Western Electric Company, with headquarters in Christiania.

Three members of the Western Society of Engineers are members of the Committee on Amendments of the American Society of Civil Engineers: Col. Peter Junkersfield, Chairman, Boston; Mr. A. Stuart Baldwin, Chicago; Mr. C. H. Snyder, San Francisco.

What Have You That the Membership Wants

Those who receive the Journal, *W. S. E.*, either make, specify or purchase a large proportion of the materials entering into engineering work. Those who manufacture have a medium in the Journal's advertising pages in which to help their sales. Those who purchase or specify will accept favorably the message of those who manufacture.

Have you a material, specialty or service that you want fellow members generally to know about? The cost of Journal space is low considering the character of membership, all of whom are subscribers. Advertising rates in the Journal have been increased slightly in line with present costs of production. The cost still is low as compared to other Journals commonly used to reach the same class of men as represented in the Journal's subscription list.

One of the present officers said recently: "My firm advertises for the reason that as an officer of the *W. S. E.* I must subordinate my company connection and it is wise that in the advertising columns of the Journal I carry that message to the membership which I cannot convey in my Society activities."

Your advertisement will be in good company in the Journal's pages.

NOON DAY LUNCHEON

J. H. LIBBERTON, Chairman.

In addressing the first noon day luncheon meeting of the season on October 8, at the Morrison Hotel, Harry H. Merrick, President of the Great Lakes Trust Co., discussed "Where Are We Heading?" He pointed out very clearly that the United States Government was a very solvent institution and that all indications were optimistic.

The value of the agricultural crops alone in 1920 is as large as our national debt. Improvements in the railroad situation since the railroads have been returned to private ownership show that they will do their share in bringing the country back to normal.

For the November and December meetings well known speakers have been secured. E. J. Mehren, Editor Engineering News-Record, who has just recently returned from a several months study of Conditions in Europe, will address the meeting on Friday, November

12. Dr. George Edgar Vincent, President of the Rockefeller Foundation, who is widely known as an educator and speaker, will address the Noon-Day Luncheon Meeting, Saturday, December 11. Dr. Vincent's speaking engagements in Chicago made it necessary for us to schedule him on Saturday. In order that every one may hear Dr. Vincent, the luncheon on December 11 will start at 1:15 a. m. instead of the regulation 12:15 p. m.

MECHANICAL ENGINEERING SECTION

A. L. RICE, Chairman.

The Committee of the Mechanical Section W. S. E., has arranged for the meetings of the year as follows:

On November 15, G. R. McDermott of the Illinois Steel Co., will present a paper on "Waste Heat Utilization," and will have as his collaborator in the presentation of the paper, F. H. Wilcox of Frey-Brassert Co.

On February 20, Mr. J. E. Bolling of the Carrier Engineering Corporation of New York City, will present a paper on "Manufactured Weather," dealing with the subject of air conditioning in industrial plants.

At the April meeting W. L. Abbott of the Commonwealth-Edison Co., will talk upon the "New Calumet Station" of his company and on June 20 will present a paper with motion pictures on the "Secret Part in Winning the War."

It is expected that the November meeting will be a joint gathering with the Chicago section of the A. S. M. E.

HYDRAULIC, SANITARY AND MUNICIPAL SECTION

WM. ARTINGSTALL, Chairman.

The H. S. & M. Com. (this does not stand for a well-known brand of clothiers but for the Hydraulic, Sanitary and Municipal Section) are, or rather have prepared the most interesting set of programs listed for this season. The special meeting held on the only rainy night in September had an attendance of over eighty, seventy-eight of whom took part in the discussion. The Chairman is fortunate in being an engineer because he could and did divide the audience into gangs (pardon me) and let them go to it. The tower of Babel has nothing on the W. S. E.

The meeting held earlier in the month, had an attendance of over a hundred. L .K. Sherman, former director of the U. S. Housing Corporation presented a very interesting paper on the housing situation during the war and the means taken to meet the scarcity of houses at that time. This was illustrated by over 200 lantern slides taken from Maine to California and from the Canadian border to the Gulf. The discussion was lively and much to the point. Unfortunately the evening was hardly long enough to let everybody say all they wanted to so the Executive Committee is making arrangements for a visit to the Studebaker Housing proposition at South Bend, Ind. This will make a pleasant excursion of a day and we expect to be able to invite our wives, or somebody's else, or our girls if we are bachelors. The city of South Bend is one of the beauty spots in this section of the country—the site of Notre Dame University with its wonderful art gallery—and also the site of St. Mary's Academy with its wonderful girls.

The Chairman promises not to monopolize the discussion at any of the meetings so there is plenty of opportunity to exercise your oratorical powers.

ELECTRICAL ENGINEERING SECTION

A. F. RIGGS, Chairman.

On November 12 there will be a National Meeting in Chicago of the American Institute of Electrical Engineers, which will be directed by the Chicago Section of the A. I. E. E., in which the Electrical Section of the W. S. E. will fully participate.

The subject of this meeting will be "Protective Devices." Speakers will be V. E. Goodwin, Engineer Lightning Arrester Department, General Electric Co. The subject will be "Static Condensers." C. T. Allcutt, Research Engineer of the Westinghouse Electric & Mfg. Co. of Pittsburgh, will deliver a paper on "Lightning Arrester Spark Gaps." D. W. Roper of the Commonwealth-Edison Co., will talk upon "Lightning Protection." N. A. Lougee, Consulting Engineer for the General Electric Co., Schenectady, N. Y., will speak upon "Performance and Life Run Tests of Oxide Film Arresters."

The Chairman on the Committee of Arrangements will be H. A. Lynette, of the Westinghoue Electric & Manufacturing Co.

LIBRARY SERVICE

MISS ELTA VIRGINIA SAVAGE, Librarian

Have you ever made an attempt to find out what the Library Service of the Western Society can do for you?

Every effort is now being made to further develop this service for the use of our members. Through the addition of book shelves it has been possible to arrange the material more conveniently.

In so far as possible we want to make this library YOUR LIBRARY. You can not personally subscribe for all the technical publications. If you did, you have not the space at your disposal to keep them. Are the journals for which you have need on our list? If not, please call our attention to the fact.

Are you in touch with the latest books and reports bearing upon your line of work? Prompt attention will be given to all telephoned questions which fall within the limits of our collection. Books may be taken from the library for use in the office or home. As soon as you come in and tell us of your needs we will make an effort to meet them. The oftener you ask the librarian to help you, the more improvement will be made in the service.

You are helping the Society by allowing it to properly perform its functions, when you avail yourself of the benefits it can give you. WILL YOU—come in and avail yourself of the library service—offer suggestions for its improvement—tell us of your interests in order that we may keep you informed. DO THIS BEFORE YOU FORGET ABOUT US.

YOUNG MEN'S FORUM

BENJAMIN SHAPIRO, Chairman.

Saturday afternoon, October 16th, Wm. H. Brittigan spoke at the opening meeting of the Young Men's Forum. Mr. Brittigan used his experience as a Real Estate Operator to show, what in his judgment, are the essentials of success. It was very interesting to know that the qualities necessary for success in the Real Estate business are the same as those necessary in professional life.

Mr. Brittigan said that in order to succeed a man must add to his fund of knowledge by constant reading, should observe everything, not neglect to profit by his experience and concentrate on his work.

In order to place one's ability, and that is what a professional man has to sell, it must be done in a way which will first attract attention and create an interest which will result in action. Salesmanship of one's service has been a difficult thing for most Engineers.

The Young Men's Forum, in planning their Saturday afternoon meetings, has in mind increasing the opportunity for the members of our Society to become acquainted with each other. The attendance was quite satisfactory but there can always be more.

On Saturday afternoon, November 13th, at 1:30 P. M., the November meeting of the Young Men's Forum will be held in the Society rooms.

W. H. Fogerty of the Alexander Hamilton Institute, formerly of the Staff of "Engineering & Contracting," will give a talk on Mental Training: "The Right Habits of Mind are More Important than Knowledge."

All members of the Society and their friends are invited to this and all other meetings of the Young Men's Forum.

ENTERTAINMENT COMMITTEE

A. B. BENEDICT, Chairman.

LADIES' NIGHT

To begin the social activities for the winter season the Entertainment Committee has planned an informal reception to the ladies, to be held in our regular meeting rooms on the evening of Friday, November 5th.

We shall have music, movies, cards, dancing and refreshments, and NOTHING of a technical nature.

Come out everybody — forget for once that you're an engineer. Let's show the ladies a good time.

The steel industry looks to the railways to keep it in a healthy, normal condition for some time to come, is the opinion of Charles M. Schwab, as stated in a recent interview. He pointed out that normally the railways use about one-third of all the steel produced. For the past five years railway purchases have fallen far below this average, and Mr. Schwab believes that a steady production of steel for several years will be necessary to make up this deficiency even if orders from other sources fall off.

NOVEMBER MEETINGS

Telephone, Telegraph and Radio Engineering Section

November 4th—Mr. Fred L. Baer, Sales Engineer, Automatic Electric Company, of Chicago, will present a paper on the "Calculation of Telephone Trunking Equipment." Mr. Baer will illustrate this paper with slides showing clearly this scientific method of estimating quantities in advance of requirements.

Bridge and Structural Engineering Section

November 8th—Mr. Charles Evans Fowler, Consulting Engineer, New York, "The Evolution of Bridge Design." Mr. Fowler's large experienct in the design of many notable bridges qualifies him to speak with broad knowledge on this subject. This paper is presented on page .. of this issue.

Illustrated.

Gas Engineering Section

November 10th—Prof. S. W. Parr, Professor of Applied Chemistry of University of Illinois—The subject will be "Fuels and the Future." The depletion of our natural resources rapidly progressing makes it impeiative to study and know what the future necessity will be.

Joint Meeting Electrical Engineering Section with the Chicago Section A. I. E. E.

November 12th—Subject "Protective Devices." This is a Dinner Meeting, at the City Club. Lightning Arrester Spark Gaps, C. T. Allcutt. Safe Performance of "O. F." Lightning Arresters, N. A. Longee. Protection on 4,000 Volt Circuits, D. W. Roper, Electrostatic Condensers, V. E. Goodwin. Dinner .... per plate. Reservations may be made at this office. The National Council of the American Institute of Electrical Engineers will meet in the conference room of the Western Society of Engineers in the afternoon.

Mechanical Engineering Section

November 15th—"Waste Heat Utilization." This subject will be presented by G. R. McDermott Mechanical Engineer, Illinois Steel Company, and by F. H. Wilcox, Mechanical Engineer, Freyer Brassert Company. Successful methods of preventing losses which, at the present high cost of fuel, are important will be described.

Railway Engineering Section

November 18th—C. W. Gennet, Jr., Engineer, Robt. W. Hunt Company, "Steel Rails." This paper will deal with the specification and manufacture of Steel Rails and a study of the useful life and failures in service. It is now 50 years since the first manufacture of rails was started in this country.

All meetings, except November 12th, are to be held in the rooms of the Western Society and begin at 7:00 p. m. The papers will be preceded by a Moving Picture—of interest to all who will attend.

Report of the Terminals Committee on the Chicago Convention of the American Association of Port Authorities

To the technicians as well as the business interests of Chicago and its tributary industrial and producing districts, the annual convention of this Association, just closed, was fraught with unusual interest of which our membership at large should be appraised. At this convention, Marine transport as applied to Port-Terminal Development for inland as well as for Seaboard ports, received intensive discussion and recognition in the official proceedings, largely through the efforts of the Committee.

Soon after the announcement of the Convention early in the year, the Terminal Committee, as its first duty, undertook to secure a thorough consideration of Chicago's technical problems, as it became evident that the Port of Chicago, in the minds of the average outsider was not only non-existent, but provided no definite potentialities. Likewise the tributary waterway projects, upon which Port of Chicago depends for its ultimate development, were generally regarded as more or less nebulous and savoring of local selfish propaganda. But this mistaken impression has now been corrected and it is believed a true impression has been left with these representatives of the great domestic and foreign shipping gateways that Chicago intends to assume her rightful position as the first water and rail gateway of the mid-continent, and commands the necessary resources for its accomplishment.

From the forty odd addresses covering the entire field of discussion, certain outstanding points may be cited as the major contributions:

1st. That the Port problem involves as much the essential element of R. R. Terminal movement as of marine movement and that the rail problem should receive concurrent study in equal detail. To this end the following resolution was submitted by the Committee and adopted in substance unanimously:

> "Resolved that, in view of the evident growing importance of terminal planning and rail-water movements in port, the American Association of Port Authorities appoint a committee to co-operate with such technical bodies as deal with this subject, to the end that such co-operative effort should bring about more rational development of the terminal service feature."

2nd. That the newer ports, especially those at or near the Canadian Border,, are making rapid progress and a strong bid for overseas and coastwise traffic.

3rd. That in the design of harbor works these newer ports have the advantage of freedom from the burdens of port policies resulting largely from long established precedent from which the older ports now find it difficult to escape, except at very large expense of reconstruction—a handicap which must be recognized.

4th. That the old pier system of developing the littoral, except in special cases of unusually high land values, is today seriously questioned as against the quay system or substantial realization of the latter in the form of wide piers (and intervening mooring basins), with sufficient capacity to accommodate, in case of necessity, both in and outgoing cargo to promote more rapid turn-around of vessels.

5th. That the functions of warehousing in accelerating Port movement and reducing the cost burden on commerce passing through it is very important, especially required in addition to transit sheds for seasonal commodities and tonnage held beyond the normal time limit.

6th. That the long prevailing policy of using steam railroad rolling stock for storage and merchandising should be abated and that this rolling stock should be kept in maximum circulation to lessen the burden of terminal congestion, especially at times of heavy arrivals and departures of vessels.

7th. That the zoning principle in large ports should be developed and applied to both rail and water facilities, i. e., that the design must incorporate special features required to suit special service and commodities, as few harbor works can in fact be successfully designed as a Jack-at-all-Trades.

8th. That proper handling equipment may be essential to the economic success of competitive ports and when designed for the purpose may distinctly modify the relationship of pier and warehouse construction, floor levels, connecting thoroughfares, etc.

9th. That the Mississippi Barge service to the Industrial District and Port of Chicago, through the Illinois Canal project will be of great economic benefit as a transport agency, locally and nationally.

10th. That the Great Lakes-St. Lawrence Water route is likewise a matter of serious interest to this region and, outside of the proper allocation of benefits and assessments between districts affected, presents no structural difficulties of a major character.

11th. That these two waterway projects have a definite basic regulative function to perform in the transportation system of the country, the importance of which should have been long since appreciated before the necessity arose of, in affect, isolating further the great producing interior through the greatly increased rail rates of the present time.

12th. That the distribution of overseas tonnage throughout the Mississippi Basin needs careful study and analysis for the purpose of securing more economic and direct movement through port and the minimum cost of haul to destination.

13th. That the two variable elements of (1) differential port charges and (2) competitive water hauls will have an important effect upon the policy of routing tonnage from the interior producing districts for quickest dispatch and minimum cost of transportation.

14th. That joint rail-water routes as already effective throughout the major portion of the Mississippi Basin have in effect, established a transportation policy which may likely become of great importance in the future commercial development of the interior.

15th. That the Port of Chicago exists largely as a potentiality and calls for immediate consideration in all its various aspects, involving the distinct features of a passenger, commercial and industrial port in which, perhaps, the major aspect is that of a rail-water gateway and trans-shipment point, lake to rail, rail to barge and barge to rail.

16th. That the national policy of conservation should express itself definitely in the most complete possible co-ordination of rail and water operations, rather than the policy of destructive competition, too often advocated as a purely partisan expression of opinion.

In presenting the above to the membership of the Western Society of Engineers, perhaps the main thought which the Terminal Committee can emphasize as the collective opinion of this important convention is that expressed in the preceding paragraph, viz., the great necessity at the present time for collective consideration of the broad problems of transportation confronting the Nation, not only as to the Port Administration proper but also as to rail and water routes, gateways and especially terminals, for it is felt that the Terminal question has not in the past been given the intensive thought and development which it has deserved. The Committee therefore intends to undertake active study of this situation as it affects the Industrial District of Chicago as its next major activity.

J. R. BIBBINS, Chairman.

APPLICATIONS RECEIVED

Applications for membership were received by the Board of Direction at its meeting held October 18th, 1920, as follows:

No.	Name	Location
126	Ferdinand M. Moore	Chicago
127	P. F. O'Donnell	Chicago
128	J. A. Piersol	Chicago
129	Edgar M. Rhyner	Brooklyn, N. Y.
130	Chas. W. Pick	Chicago
131	H. J. Armstrong	Chicago
132	D. R. Hettelsater	Kansas City, Mo.
133	Joseph L. Mellish	Chicago
134	Thomas Michels	Chicago
135	Harry R. Allensworth	St. Paul, Minn.
136	George James Richards	Erie, Pa.
137	R. C. Wieboldt	Chicago
138	George B. McClary	Chicago
139	Henry W. Smith	Huron, S. D.

Members are requested to communicate with Secretary with regard to qualifications of the above applicants for membership in the Society.

EDGAR S. NETHERCUT, Secretary.

EMPLOYMENT SERVICE

Do you need assistants?
Do you want a position?
Do you feel that you have men in your employ that are needed more in some other position?
Do you wish a change or advancement? The service we render is to bring men together for their mutual benefit. In order to do this, we offer free of charge, this Employment Service. Will you use it?

Positions Available

A-90: Practical Maintenance man wanted who is thoroughly familiar and experienced in the construction and repair of all kinds of boiler room instruments, such as steam meters, $C. O._2$ recorders and draft gauges.

A-86: WANTED—DRAFTSMEN familiar with freight car construction. Write fully experience and salary expected. General American Tank Car Corp., East Chicago, Ind.

A-87: WANTED—A DEPENDABLE and experienced structural steel estimator, an Illinois graduate who is looking for a better job.

A-88: OPENING FOR A 1919 graduate having spent the intervening time in the design and detailing of reinforced concrete structures, with a view toward eventually entering our sales organization.

A-89: WANTED—FIRST-CLASS brick paving inspector for temporary work in Iowa. May lead to permanent location. Salary depending on experience.

Positions Wanted

B-709: GRADUATE C. E., Northwestern University, has had experience in general construction work, road construction and was asst. engr. of large city; desires position as supt. of construction; designer, structural steel or reinforced concrete, or as estimator.

B-710: MECHANICAL ENGINEER, age 35, technical education, thorough knowledge of the designing of power-plants, heating, ventilating, plumbing and fire protection; can take entire charge of mechanical department of an architectural or engineering firm, including the making of plans, specifications, estimates, reports and the superintending and testing of installations; best references.

B-711: GRADUATE U. S. A. TOPOGRAPHICAL School F. A. R. D. Thorough training in topographical work, railroad map and municipal drafting, seeks position along above lines.

B-712: CHICAGO LICENSED ENGINEER, Broad experience in engine construction, mining machinery, motive power and equipment. Best of references.

B-715: PROFESSOR ELEMENTARY MATHEMATICS wants position teaching elementary math., plane surveying or elementary physics. Night classes only.

B-716: GRAD. M. E. ARMOUR INS., EXPERIENCED designer of machinery, plant layout, etc. Production engineer of plant with machine shop, steel furniture shop, paint, electrical surgical inst. depts. wants position as (1) production engr., efficiency engr. or asst. supt.

B-717: RELIABLE YOUNG MAN OPEN TO position as rodman, instrumentman or chainman.

B-718: CAPABLE C. E. GRADUATE DEsires to make connection with commercial engineering concern where his experience will be beneficial. Best of references.

B-719: THOROUGHLY COMPETENT ENGINeer open for position as genl. supt., shop mgr., mfg. machy. along following lines: Steam, gas, steel and iron, marine turbines, reciprocating, ice refrigeration, valves and fittings, heavy and light.

B-720: GRADUATE C. E., 18 YEARS' EXP. leading bridge and railroad companies wants position with bridge work in office or field.

B-721: GRAD. U. OF WIS. 1910 ELEC. ENG., exp. testing power maintenance departments wishes position with industrial plant as (1) power and maintenance, elec. (2) asst. to supt. power or (3) elec. engr.

B-723: ENGINEER ON HARBOR STRUCtures, foundations, steel and concrete structures of all kinds, familiar with design and details of construction of buildings and other structures wants position as designing engineer, squad boss, chief draftsman, estimator or supervising engr., preferably in contractor's office.

B-724: ENGINEER WITH EXPERIENCE IN power plant operation and design, industrial plant design and conveying machinery. Open to position in similar work.

B-725: TECH. H. S. GRADUATE. DESIRES apprenticeship in civil or mech. engrg.

B-726: ENGR. HAVING EXPERIENCE AS chief draftsman, mech. engr. and shop supt. of large mfg. concern desires positions as (1) mech. engr., (2) shop supt. or (3) designer of machinery and power plants.

B-728: MAN HAVING STRUCTURAL ENgineering experience desires position along structural lines.

B-729: YOUNG MAN DESIRES TEMPORARY position as surveyor or other civil engineering work where his experience could be utilized.

Positions Wanted—Continued

B-730: MECH. ENGR. HAVING MANUFACTURING experience in executive positions wants position as (1) sales engineer, (2) factory superintendent or (3) production engineer.

B-731: A-1 ENGINEER FAMILIAR WITH theory of deflection, continuous girders, swing bridges and secondary stresses. Also special problems in intermediate structures with the slope deflection method. Desires to become associated with responsible firm.

B-732: TECH. GRADUATE, THREE YEARS' experience, wants position as structural draftsman.

B-733: POSITION WANTED AS BRIDGE engr. or construction engr. by man of broad experience. Best references.

B-737: POSITION WANTED, EXECUTIVE. Former positions as draftsman, engineer, mechanical and construction supt. Eighteen years' experience. Steel, chemical and oil refining plants.

B-743: CIVIL ENGINEER, AGE 36, MARRIED, graduate of Stanford University, twelve years' experience, ten years' active charge of hydraulic, railroad, wharf and concrete bridge work on Hawaiian Islands, as chief engineer and field engineer; have had full charge of projects from the preliminary surveys to completion; will consider a position as chief engineer or field engineer along the above lines; salary, $4,800. Best references.

B-745: GRAD. C. E. ARMOUR INST. WITH seven years' exp. in R. R. and modern factory construction, desires position as supt. of const., const. engr. or resident engr.

B-747: MECH. DRAFTSMAN WITH EXPERIENCE in machine and tool design. Has had two years' practical shop work and four years' mech. drawing.

B-748: MECH. ENGR. WITH KNOWLEDGE of power plant drawing, tool designing and sales experience desires position in (1) sales engineering; (2) production work, or (3) power plant, heating and vent. design.

B-749: SITUATION WANTED AS STEEL metallographist, steel chemist or chemical engineer, grad. U. of Ill., 1920. B. S., who has had practical laboratory experience during summer.

B-750: CAR DRAFTSMAN DESIRES POSITION with railway or railway supply company, experienced on pattern shop and foundry work.

B-751: MECH. ENG., 12 YEARS' EXPERIENCE with public utility company, broad business training as assistant to chief executive, married, wishes to get into a field where salary is proportional to responsibility.

B-752: ENGINEER AND EXECUTIVE, TECHNICAL education plus training in business administration; 12 years' experience in manufacturing plant construction and consulting engineering; accustomed to positions of responsibility requiring exercise of both initiative and diplomacy; well trained in systematic control of costs; desires permanent connection with growing industry where engineering knowledge is essential; salary to start, $6,000-$10,000.

Positions Wanted—Continued

B-753: GRAD. C. E. TWENTY-FIVE YEARS' exp. in design, construction and operation of railroad, mining and municipal engineering. At present consulting engr. specializing on water works and electric light plants, is open for proposition of magnitude. Will consider (1) going abroad on large engineering project. (2) Managing manufacturing concern, or (3) position with large public service corporation. Best references.

B-754: MECHANICAL ENGINEER, AGE 35, technical education, thorough knowledge of the construction of power plants and the operation of the steam dept., also several years' experience as supt. of light and medium machine shop employing 500 people. Local position desired.

B-755: GRAD. C. E. WITH BROAD KNOWLEDGE of concrete and steel structures from designing to superintending their construction, seeks position with industrial firm or railroad company. In charge of designing. Best references.

B-757: CAPABLE ENGINEER AVAILABLE as designer of special machinery, well adapted to take charge as supt. or plant and direct machine design.

B-758: MAN HAVING BROAD EXPERIENCE desires position as (1) bridge draftsman, (2) general R. R. draftsman (construction) or (3) steel and reinforced concrete designing.

B-759: STEEL DETAILER WISHES TO connect with reliable concern offering opportunity for advancement.

B-758-A: GRADUATE C. E., 1916, WITH four years practical experience wants position as construction supt., unit cost eng. or sales eng.

B-762: AMBITIOUS YOUNG MAN WITH EXPERIENCE desires position as cement inspector.

B-763: MECHANICAL AND STRUCTURAL draftsman well qualified to make drawings for catalogues desires part time work.

B-765: MAINTENANCE ENGINEER OR CONSTRUCTION foreman for chemical or industrial plant desires position along above line.

B-766: MECHANICAL DESIGNING ENGINEER of metallurgical and chemical plants and special machinery, 16 years' experience seeks position in above field.

B-769: DETAILER-CONSTRUCTION, 4½ years' experience in heavy construction, especially R. concrete, steel and timber. Also can do some designing in either of the above. First class references. Available immediately. Salary, $175.00 to $200.00 per month.

Notice----Society Badges

WESTERN SOCIETY OF ENGINEERS
FOUNDED 1869

THE Officers of the Society have succeeded in making a more advantageous arrangement for the manufacture of our Society Badges than we have heretofore had, and the Society is now able to furnish them to the membership at the following prices. - - - - -

Gold badge, with blue enamel, for Members and Associate Members - -	$3.00
Silver badge, with green enamel, for Junior Members and Affiliated Members	$2.00

Show Your Loyalty By Wearing the Badge

TECHNICAL SECTION

JOURNAL OF THE
WESTERN SOCIETY *of* ENGINEERS

Volume XXV NOVEMBER, 1920 Number 15

Application of Engineering to Transportation Problems

*By James A. Peabody

Presented Sept. 16, 1920.—R. R. Section

WHILE the title of this paper is somewhat definite, I was advised that in addressing you, all the liberty desired could be used in handling the subject. Therefore, if you feel that I have at times strayed from the subject, it is because I have taken advantage of the permission given.

The production of a railroad is traffic.

Inasmuch as there is more to be transported, both passenger and freight, than the railroads now have capacity for, it seems but reasonable that the railroad which gives the most facility or increases its capacity the fastest will practically automatically get the most business.

Every one knows that the transportation facilities of the railroads of the United States are far below the requirements and that enormous sums of money must be spent in order that the railroads may regain their position.

Numerous solutions of the difficulty are offered and these I think, can all be divided into two classes; first, efficiency in use of present facilities; second, increase of facilities.

Relative to the first we have heard a great deal since Mr.—now Justice Brandeis, brought it to everyone's attention so forcibly, and as to the second, the five hundred millions mentioned by the late Mr. J. J. Hill as being necessary that the railroads should spend each year for several years to improve them to a point where they would be able to do their part in handling the business of the country, would not now be sufficient. Current estimates of amounts required are from a billion dollars up.

Not all has been said or done relative to efficiency in use of present facilities; for instance: Would not the railroads find a quicker means of relieving company coal cars if they had to pay per diem? These cars now stand at the coal chutes until the coal is wanted, very often several days. Why should not this coal be unloaded at once into stock piles or otherwise, and the cars started back to the mines instead of being used as storage bins? The loading of cars to nearer capacity, the short routing of freight and other things of like nature may be effected but such things seem to come more within the province of the operating man than of the engineer, though the engineer may, even here, with his fresh point of view, assist very materially.

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* Signal Engineer, C. & N. W. Ry.

It is relative to the second solution, viz. the expenditure of the vast sums that must be made that the engineer should give his attention. His knowledge, ability and best thought must be brought to bear in assisting the executives in determining where the money is to be spent if tremendous waste and even scandals are to be prevented.

It is very easy for any one to criticize after work is completed and with the close government control we now have and the number there are who desire government ownership, it will require great care if, during the investigations that will be made by the government in determining what the returns of each railroad are to be, there does not occur these criticisms and scandals.

It seems to me that we have come to a new period where the railroad engineer has an opportunity to come into his own, but where railroad engineers, if they are to make the best of their opportunities, must get into closer contact with the necessities of their business than ever before.

In the distant past when additional facilities were required, it was only a question of building an additional or an addition to a railroad. Later it became necessary to double track and in a few instances, to install three or four tracks, together with yard and engine facilities, It is but a few years since signaling and interlocking were introduced and it was sometime afterwards before it was realized that both signals and interlocking could be used to facilitate traffic as well as protect it. There is no doubt but that properly installed block signaling and interlocking alone would make easy the operation of some lines that are now badly congested and pay heavy returns on the investment.

We are now at a place where great increases must be made in facilities to take care of present necessities and where it now would appear that money will soon be obtainable in practically unlimited quantities and therefore, the limit of the amount of work to be done will be that of the amount of labor and material that can be obtained.

Traffic is handled by the operating men over tracks furnished by the Civil Engineers, by means of locomotives and cars furnished by mechanical engineers and with the assistance of telegraph, telephone and signals furnished by communicating and signal engineers. But can you find where any one, engineer or otherwise, has planned the whole so that the parts will fit properly together? It is true that in the construction of new railroads something of this sort is done, generally by some one financially responsible, but there the matter has too often ended and the railroad has been left to grow, each part obtaining attention as some official directly interested in that particular part has brought it to the attention of the higher officials and obtained authority for expenditures.

When some big improvement is to be made such as a large terminal, an organization is often created which may make a study of the existing necessities and future requirements but such an organization is more apt to be made up of men selected for their ability to carry out the work from plans and instructions laid down in such definite form as to leave little, if any, leeway and when that particular piece of work is completed the organization is generally disbanded.

Special men are sometimes employed either as Consulting Engineers or as Assistants to the President or Vice President, but this is rare and few have had a permanent place in the organization.

Small improvements are almost invariably first suggested by an operating official, usually a division one who is confronted with an absolute need. If the railroad organization is of the division type, the Superintendent and Division Engineer get together and plan relief. Under these conditions effect only and not cause is usually seen and the plans, of necessity, reflect the fact.

Division officials are busy men; they have little time or opportunity to find out what others are doing and certainly neither time nor opportunity to make complete studies to determine what the possible requirements will be twenty years or even ten in advance. Division officials are generally required to get along with what they have and ask for as little as possible; this, together with the other reasons mentioned, results in recommendations for improvements which a close study with full information would show to be entirely erroneous.

An efficiency engineer has been defined as an engineer who is ready to tell anyone how to do things which he cannot do himself and far be it from me to recommend such an engineer to take care of this situation. I do believe however, that there is a place on every large railroad for a man who with proper assistance makes a specialty of studying the transportation problems and such a man I believe can properly be termed Transportation Engineer.

As to just where in the railroad organization a Transportation Engineer would best fit would unquestionably vary on different railroads depending somewhat on the size of the railroad, more on the amount and importance of the work undertaken and most on the man.

There is probably today in every large railroad organization a man who, due to his experience, breadth of vision, imagination and understanding of operating questions together with good sound judgment, is emminently fitted for the work of Transportation Engineering. Very often such a man would already have charge of some line of work and to start with Transportation Engineering could be added. However, I believe that where the proper man is selected it would not be long before he would have to devote his entire attention to the new work. In any event in order to get the proper results a Transportation Engineer must be given absolute freedom in developing his plans and authority to call on any and all departments for such information as he may deem necessary and when the plans are completed his position must be such that he would naturally be called in consultation with the other officials such as Vice President of Operation who would give the reasons for the necessity for additional operating facilities and the Chief Engineer who will advise as to the best methods for the carrying out of the work.

Where such a separate organization is formed, there should be no fear that the Transportation Engineer would take from any of the present department heads, engineering or otherwise any of their prerogatives worth retaining; on the other hand the gain would be so great as to far overbalance the objection. There would seem to be almost no limit to the possible scope of the work which might be brought under the term of Transportation Engineering because with the movement of both freight and passenger traffic to be studied, there must come studies of the growth of communities, mining, farming, urban, suburban and industrial in order to determine the trend so that the necessities of the future may be foreseen and planned for.

The studies relative to handling of freight would not only be that relative to moving trains over the road, important as that is, but also that of handling freight trucks from the time they approached the railroad property to the time emptied into the cars or freight houses and the freight thence to the made up trains and of course vice versa. The handling of passengers should also be analyzed in the same way as well as baggage, express, United States mail and railroad mail which are each a problem and each of which has a relationship to the other which is too often overlooked.

In a late issue of the "Professional Engineer" I noticed an article which started off with—"The statement has often been made that those patents which have been of the greatest benefit to mankind have been those which eliminated time and space. Without a doubt the most important has been the development of steam transportation.

The entire development of America has come hand in hand with rapid development of our railroads."

If the elimination of time and space has been so important in the past, is it not as important now? Would not the speeding up of freight cars from the twenty, thirty or forty miles per day that they now average on various railroads by ten, fifty or one hundred per cent be relatively as important as is the present speed over the speed obtained by our forefathers in the handling of their freight?

Bulk of course is a large factor in this so that the word "relative" must be considered as used advisedly.

I have spoken of the importance of moving freight trains over the road. How often when this is under consideration is a definite analysis made to determine where the difficulty lies? Wellington mentions the necessity for proper location of passing tracks but it was not until within a very short time that Mr. F. L. Dodgson developed a method of analysis to determine on the proper location of passing tracks on a single track railroad by establishing as nearly as possible an equal distance, in time, between all passing tracks. You will find his paper published in the proceedings of the American Railway Engineering Association for the year 1916. It was followed by other articles along the same line in 1917 and an actual application of the method to a piece of single track published in 1919 together with a method for analyzing double track capacity. These are altogether too long to go into at this time but after having considerable experience with them I am absolutely convinced that an analysis and a complete plan for passing tracks of each division of every railroad should be made so that as money can be obtained it may be so expended as to work toward this complete plan.

Of course, the theoretical location of a passing track is not the only thing to be taken into consideration. After the theoretical location is obtained a practical location must be selected taking into consideration the possibility of a train being able to enter and leave the passing track in either direction if possible, also to obviate curves or if not possible, to have the passing track on the outside of the main track at the curve. Another thing to look out for are highway crossings as from actual observations we have found that a tonnage freight train may lose up to 45 minutes in coupling up and getting away from a passing track where the train had to be opened for one highway crossing and this will in itself upset a dispatcher in making meeting points, particularly if traffic is running heavy. Another reason for so far as possible preventing the cutting of trains at highway crossings is the danger to highway traffic. There is hardly anything more dangerous at an unprotected crossing than cars standing on a side track and close to either side of highway.

After all these things have been taken into consideration it goes without saying that the cheapest place, in first cost, to construct a passing track will seldom be selected, but it is also almost as obvious that the cheapest place, so far as the cost of operation is concerned, will have been selected.

While referring to the cost of operating trains, I wish to call attention to a number of the costs which should be looked into on almost every railroad. The cost of stopping trains and the relationship of that cost to the cost of preventing that stop. We, as railroad engineers, should be ashamed to acknowledge that today there is no complete information on this subject and to show necessity for such information, I would refer to a brief paper I wrote on this subject in 1905 and which is referred to even today although the figures are entirely obsolete. A pamphlet (Bulletin No. 2) issued by the four largest signal companies, contains perhaps the best information there is today on this subject but it is anything but complete or satisfactory.

The cost of operating trains, not for the railroad as a whole, but for each engine division should be gone into in order to determine, if possible, how each may be cheapened.

The cost of switching in each yard should be known. In this matter I have been deeply interested lately but so far in my investigation I have been unable to obtain accurate costs of switching trains; the men who have given me the cost of switching in certain yards themselves doubting their own figures.

The cost of handling engines at each terminal should be known to disclose where it would be advisable to make studies relative to reducing that cost.

Analysis should be made of each piece of congested main track and methods for increasing its capacity determined together with, of course, the cost of doing the work; the relative cost of operation also should be taken into consideration . In this connection not only comes the question of proper location of passings tracks as heretofore mentioned, but also there should be taken into consideration, signaling, interlocking, the dispatching system, reduction of grades and curvature and every other item that would go to make for economical operation.

It was my good fortune to be allowed to make up complete plans for passing tracks and signals for a certain piece of railroad. This was completed some three years ago but a complete analysis of the relative efficiency before and after has never been made; however, in making a brief survey a short time since it appeared that, with the same type of locomotive in use, the average time over the division for each freight train was 17 minutes less than before the improvements were made. It was not at all unusual for some trains to be tied up on account of time limit before the improvements were made, whereas this is practically unknown since. Previous to the improvements some trains were favored and consequently were moving over the road in a very short time; this accounted for the close comparison in average time. The surprising fact of the whole matter was however, that under the new conditions the trains were averaging 50% more tonnage per train than under the former conditions.

Analysis of large terminals should be made to determine whether the handling of cars cannot be reduced materially. In a large terminal such as Chicago the consolidation of some yards would reduce the transfer work and therefore the several handlings of a car. It would also materially shorten the time required to deliver a car from the road to an industry or vice versa.

The methods generally used in the handling of LCL and trap car freight in large terminals seems to me to be very crude and it would seem that a close study of this would produce methods that would result in quicker and cheaper handling.

In all this we must not forget the passenger service and in this connection it would seem that there are opportunities for materially increasing the revenue by decreasing the cost of operation particularly in handling suburban traffic. Today I believe that the steam railroad engineer is very much behind the electric railway engineer in his knowledge of what can be done in this direction.

A subject which I think is already receiving considerable attention and which is of very great importance, is the housing of men, particularly common labor.

In connection with the subject of electrification, there is certainly food for thought as it does not seem that there could be much question but that a great many lines that are now decidedly congested on account of the gradients could have their capacity greatly increased by electrification and probably the cost of operation decreased as well.

Any engineering body or individual wishing to take up the question of Transportation Engineering will find the subject has a breadth requiring the investigation of every item of economical operation.

My conclusion is that the transportation problems of today will only be solved by the application of engineering knowledge and that consequently the engineer has a better opportunity of showing his worth today than ever before.

Discussion of Mr. Peabody's Paper

E. R. TRATMAN: As a general thing the relation of the engineer to the operating side of railway service is still underestimated or not recognized. Probably there are many railway operating and executive officers who see the engineer only as a man to make surveys, build bridges and structures, locate industry tracks and supervise construction work. Yet the engineer is by his training fitted specially for the work of analyzing and solving problems and studying the economic aspects of his work. In fact, he is beginning to receive consideration as an aid in securing economical operation as well as construction of railways.

To take Mr. Peabody's own line of service, the signal engineer met with strong opposition when he started to show that the introduction of the block system and its signals would increase the facility as well as the safety of handling traffic. It was argued forcibly that application of the block system to a division of heavy traffic could result only in such interruptions as to check train movements and cause serious congestion. Experience soon demonstrated that the reverse was the case, and that the heavier the traffic the greater the necessity for and value of a block signal system to enable the traffic to be handled efficiently. Another valuable work of the signal engineer was in analyzing the relative economy of double-tracking and signaling for single track lines of fairly heavy traffic. It has been shown in a number of cases that the capacity of such a line could be so increased by signal equipment and rearrangement of passing sidings, that a much more costly project for double tracking could be deferred for several years. These lines of work serve the illustrate very clearly the direct and important relation of the engineer to the operating service.

Grade reduction is another example, whether it includes the radical work of reducing 4 per cent grades to 2 per cent on mountain divisions where spiral tunnels afford the only means of obtaining the necessary development, or the elimination of occasional 0.6 per cent grades on lines where 0.4 per cent is the desirable maximum. The engineer's study and traffic analysis may show the possibility of increasing trainloads, reducing time and saving overtime pay by slight improvements even at considerable expense. The economic balance of expenses and operating benefits in such cases is a field for the engineer.

An example of the study of railway operating conditions by engineers, in line with the study of the location of passing tracks mentioned by Mr. Peabody, is an analysis of the traffic capacity of large terminal stations, which also was published in the Proceedings of the American Railway Engineering Association.

But, as Mr. Peabody has pointed out, the railway engineer is rarely in a position to take the initiative in such matters on his own line. He must wait until some problem or proposed work is assigned to him. And whether he is a chief engineer or a division engineer he has his hands so full of regular work and of individual projects assigned by the executive officers that he has little opportunity to stand aside and look at the operation of the line as a unit or to dig into some such detail as the efficient handling of a freight yard, a freight house, or a passenger terminal. The fact that engineers have been put in such positions as vice-presidents and assistant to president and that chief engineers have been assigned to valuation and other problems, apart from their regular technical work, seems to indicate the possible further development of such an office as that of the proposed engineer of transportation.

Evolution of Bridge Design

*BY CHARLES EVANS FOWLER

THE subject chosen for this short paper may seem somewhat aspiring, but it is the writer's hope that it may unfold a very definite scheme and awaken all engineers to a very fixed purpose as to the future of bridge design, and to get away quickly from the beginning of a decadence. The early concepts of bridge engineers of from a quarter to a third of a century ago, as the writer came in contact with them, embraced very high ideals both as to possible scientific and aesthetic attainments. From these ideals we have gradually fallen away, until we have come to look abroad too much for scientific progress, and to our brothers, the architects, for artistic help. The reason for the first is the commercialization in bridge design and construction; and for the second, the lack of any architectural education of the structural engineer by our technical schools. The correction of the latter fault is comparatively easy, as our colleges can readily be made to comprehend the need, and quickly provide the cure. The correction of the first, or purely scientific lack is far more difficult, unless we can discover some way to awaken the commercial engineer in high position and enlist him in the cure. The purpose then is, by a somewhat brief review of the developments of the science of bridge engineering to endeavor to those who were once earnest workers towards the highest ideals, to a renewal of their zeal. This refers not so much to the pure mathematics of the profession, as of its application in practice.

Looking back over the entire period during which we have undoubtedly made great progress on the whole, we find the archives of our societies cluttered up with a great mass of papers that were either lumber when they were printed or else they quickly became so. Yet this data is of a general value, or even a very definite value if we give it proper study. The periods into which we may divide the century and a quarter in which the development of modern bridge design occurred are slightly elastic, but closely enough for our purpose there are six general divisions.

First period up to 1800.
Second period from 1800 to 1840.
Third period from 1840 to 1860.
Fourth period from 1860 to 1880.
Fifth period from 1880 to 1900.
Sixth period from 1900 to 1920.

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FIRST PERIOD HISTORICAL

The first period previous to 1800 requires only brief attention, as it contributed only matters of general value to our modern needs, beyond the first use of iron in bridge construction; that is the use of cast iron in such arches as the Coalbrookdale bridge in England, constructed about 1773 to 1779, or nearly one hundred and fifty years ago, and many bridges of this type are still in use. Very notable too was the fact that Enler's theory of the elastic column was proposed during this period. True we might go back even farther to the use of stone and concrete by the Romans, and early engineers, but with little real profit. The interesting fact of the period, so far as the United States is concerned, was the building of the first real bridge in this country in 1660, over the Charles river at Cambridge, and termed the "Great Bridge."

SECOND PERIOD, PRIMITIVE TRUSSES

The second period (1800 to 1840) was of value in that in the year 1800 the study of the strength of engineering materials was begun. During this period there were built many modern bridges of considerable note and merit. The first of these to be considered in our study of bridge evolution was the first true bridge truss, the Town Lattice with chords and a web system; the first one being built in 1820. The construction of numerous wooden bridges, many of them of the Town Lattice type, represented evolution and laid the basis for the invention of our modern truss types.

THIRD PERIOD, MODERN TRUSSES

The third period (1840 to 1860) marks its very beginning by the invention by William Howe of the truss bearing his name in 1840. This was certainly due somewhat to heredity and environment, as two brothers of his were inventors, one of them being Elias Howe the inventor of the sewing machine. This type of structure was a vital factor in the development of our great railway system, and the first bridge the writer was called upon to design in 1887, was two Howe truss spans for a loading of 2-92.3 ton engines.

This type still continues to be built in timber countries, and they have also played a large part in the bridge engineers education. During the same year the first iron truss in this country was built over the Erie canal at Frankfort, N. Y.

More important, however, to the modern science of bridge engineering was the building in 1840 of the first Whipple truss, the progenitor of our modern iron and steel bridges. The Pratt truss was invented by Thos. W. and Caleb Pratt, in 1844. These three, the Howe, the

Whipple, and the Pratt, all invented within a period of five years, are the basis of all we now have to be proud of, but strange to say "the last shall be first," was true in this case, as of the three the Pratt is the only one still in general use.

Along with, or soon after such important developments, came the beginning of the use of the testing machine in engineering work in 1850, and our profession of bridge engineering was thus during this decade fully launched upon its career. The only other important invention of this period which we will note, was the building in 1852 of the first Bollman truss at Harper's Ferry on the B. & O. Railroad.

While we have already noted the development of the theory of columns by Enler previous to 1800, the work of Fairbairn along this line in 1840 was a distinct advance, and was followed just before and after 1855 by the investigations of Gordon and W. J. M. Rankine. For the real theory of columns we must yet refer to and accept the Enler findings, and it is more than an even chance that the practical formulas of Gordon, and the Gordon-Rankine may be our final goal, when the full review is made of our column test data.

Just antedating the fourth period, or the beginnings of modern long span truss bridges, was the construction of the Conway and Britannia tubular bridges by Stephenson in England about 1850. The Britannia bridge was a continuous girder of four spans, the longest being about 460 feet in the clear. The tests made of models of the tubes at Hodgkinson were among the most extensive ever made. The fact that modern English trains are even now run over the Britannia bridge speaks well for the care with which the calculations and tests were made.

The Victoria tubular bridge at Montreal was built by the same engineer just subsequent to this of 24 spans, and contained a channel span of 330 feet. The design for a bridge at Niagara of this type was made by James Hodges in 1850, but evidently due to a lesser possible cost, Roebling in 1856 constructed the Niagara Suspension bridge for railway use, of 821 feet span. Upon its completion he said in his report to the Directors, "as regards the success of your work more has been accomplished than was promised. The idea of a perfectly rigid structure, such as a tubular bridge, was never held out."

This was the first use of the suspension type for railway traffic, and the experiment demonstrated that a suspension bridge was not suitable for such live roads, until very long spans with a great dead weight were necessary, and which like the Williamsbrug and the Manhattan bridges in New York City have dead weight sufficient for stiffness.

FOURTH PERIOD, LONG TRUSS SPANS

The fourth period (1860 to 1880) marks the first building of really modern long truss spans, in the construction by Linville in 1863 and '64 of the Steubenville bridge, having 320 feet for the longest length of its several spans. The first Post truss was built at Newburgh, N. Y., in 1865 for the Erie railway, and it is interesting to note that of the three types of simple trusses most economical theoretically, the Post, the Pegram, and the Warren, only the Warren survives. This may be termed our most efficient type of truss, for as my chief engineer W. H. Jennings once said, "it is working all the time in carrying its loads towards the supports."

Referring again to long spans as the outstanding feature of this period, we have the Fink bridge at Louisville which was constructed during 1868 and '70. The deck spans were Fink trusses, a type now nearly obsolete in bridge construction or for carrying moving loads, but still very much in vogue for carrying the practically dead loads in roof trusses, for which latter type of loads it is well suited. The channel span, however, was a Warren truss of 390 feet, with four sub panels to each main one. This type is frequently found to be the most satisfactory for our modern designs, both as to efficiency and economy.

The Eads bridge across the Mississippi at St. Louis built in 1868-70 with its wonderful arch spans of 502 and 520 feet, was distinctly in advance of its time. The design is a beautifully balanced piece of bridge architecture, and the engineering features are notable in every respect, especially with regard to the use of chrome steel for the tubes composing the arch ribs. This was the first attempt at using alloy steel for bridges, although the percentage of chronium actually used is very doubtful.

The Linville 420 feet span built at Cincinnati in 1872 was a most remarkable feat; but it was soon eclipsed by Bonscaren in 1876, in the 519 feet span for the Cincinnati Southern Railway, and for many years this was accepted as the approximate limit for simple spans. The Bonscaren specifications were an important feature in the progress of bridge design in the following two decades; but the writer believes that to C. Shaler Smith, the engineer of the Kentucky High bridge, built in 1877, and of the first Lachine bridge, we owe the greatest debt for the fundamentals of our modern profession. The enthusiasm and skill that he displayed, were in large measure transmitted to his pupils of whom Moulton, Pegram, Howe, and Grenier made great and marked success. Moulton related that once upon taking his vacation Mr. Smith asked where he was going and upon being told that he was expecting to visit some notable bridges, replied "remember that most bridges are examples of what not to do!" This is still true of many bridges.

FIFTH PERIOD, SCIENTIFIC DESIGN

The fifth period (1880 to 1900) was the one representing the greatest advance in both theory and its application to practice. The specifications of Thacher and Cooper became standards, and the Cooper "E" loadings were established as the standard for railway live loads. The original English trains of coaches represented only about 1680 pounds per lineal foot, and up to 1850 the loading used was about 2000 pounds per lineal foot, as shown on the diagram figure 1. When the writer began work on the Hocking Valley in 1887 most of the bridges were of a capacity suitable for carrying only 60 to 70 ton locomotives, and when Thos. H. Johnson of the Pennsylvania Lines West adopted the loading of two 92.3 ton engines, and the method of calculating live load stresses by panel loads, it was considered a marked advance. The same engineer did notable work in investigating the tests then made for bridge columns, and he and Thacher were primarly responsible for the adoption of straight line formulas.

This period saw the gradual change from iron to steel for the manufacture of bridges, and one of the first large applications of steel was for the Sibley bridge in 1888, with 400 feet as the maximum length of its spans. The loading for this bridge was approximately E.24 locomotives, followed by 3000 pounds per lineal foot. The steel for tension members had an ultimate strength of from 60 to 70,000 pounds and for compression members of from 75 to 85,000 pounds per square inch. The tension unit stresses for the long spans were determined from the Launhardt formula $12{,}000\ \frac{1\ \text{Min. Stress}}{2\ \text{Max. Stress}}$ while for the short spans the tension built stress was 12,000 pounds per square inch, except for the counters it was 8,000 pounds per square inch.

The steel used by Monson in 1889 and '90 for the Rula bridge over the Missouri river was 80 to 90,000 lbs. with a minimum elastic limit of 50,000 lbs. for compression members, and 70 to 80,000 lbs. for tension members with a minimum elastic limit of 40,000 lbs. That used for the Nebraska City bridge over the same river, was 67 to 75,000 lbs. for tension and compression members, and 40,000 lbs. for the minimum elastic limit.

The bridge engineer of this period obtained his results at a great expenditure of mental labor, but the treatise by Dubois was of very great assistance, and the Osborn tables and the Thacher slide rule soon greatly reduced the labor of calculations. During the early portion of the period, however, one was often forced to go back to fundamentals and develop nearly everything from basic principles as found in Rankine, Kirkaldy, Wood and works and mechanics. The range of investigation necessary, may be understood from the fact that on the

Hocking Valley we had plate girders, Queen post trusses, Howe trusses, as well as Warren, Post, Pratt and Whipple trusses. These had a variety of detail that it would require too much space to review; but one point will illustrate one of the many puzzles presented, in that the pins in Post trusses of about 250 feet span were very long and only 2¾″ diameter, and the calculated fibre stress was about 250,000 lbs. per square inch. The first real relief as to fixing the qualities for iron and steel bridges, occurred when the engineering congress at Paris in 1890, laid the basis for standardization.

The American Society for Testing Materials published their first volume at the end of this period, adopting as the standard for bridge steel 60 to 70,000 lbs. per square inch ultimate strength. We at the Youngstown Bridge Company adopted soft medium steel for buildings with an ultimate strength of from 55 to 65,000 pounds per square inch, and the adoption of this in the writer's "General Specifications for Steel Roofs and Buildings" soon after 1893, is believed to be the first that this grade of steel was specified, but which has now become the standard for all structural steel.

The great development of reinforced concrete bridges during this period has had a marked effect upon general bridge practice, but will not be discussed further than to call attention to its probable wide adoption by railways for spans up to 100 feet or possibly 125 feet, to the exclusion of many plate girders. This will come as the result of the gradual betterment of reinforced concrete, and of the growing cost of steel hapes and plates. The engineer has more chance for personal initiative and choice with reinforced concrete, in most matters of design and construction, and we may therefore confidently expect that this will bring about the restriction of steel to longer spans or those having a length of 125 feet and upwards.

During this fifth period there was also waged the battle of pin connected versus riveted bridges, and during the early phases of the controversy my friend, the late George H. Thomson, bridge engineer of the New York Central, stood almost alone in a strong advocacy of riveted work in preference to pin connections. The first adoption of riveted truss bridges was for spans of from 100 to 150 ft., but upon the practical demonstration of their greater stiffness and better wearing qualities, the superior limit was gradually extended; and with the widespread use of air guns for field riveting their cost was so reduced that soon spans of any length were built in preference to pin connected. The Forth Bridge had already been built before 1890 of all riveted construction, so that it was considered wise by L. L. Buck to make the Niagara Railway arch of 550 feet span of the riveted type, as early as 1896. The unit stress for rivets was taken at the low value of 6500 lbs. per square inch, and upon a thorough reriveting in 1918 and 19 the writer found the rivets in general good condition, except that many had been poorly upset originally by hand driving, and the plates and angles had not in some cases been drawn tightly together. So when one new rivet was redriven by an air gun those around would often be loosened, but the total number cut out and replaced was only about 11,000 in number. The bridge having been originally designed for about E.37 loading, the rivets were only stressed to between 10,000 and 11,000 lbs. per square inch in shear for E.60 loading, including full impact and secondary stresses.

The other notable work of this period covered the completion of the Roebling Brooklyn suspension bridge of 1595.5 feet span in 1884 and the beginning of Lindenthal's work in special types of structures, by the building of the Seventh Street eye bar suspension and the Smithfield Street Pauli trusses at Pittsburgh, which finally culminated in the recent building of the Hell Gate Arch of nearly 1000 feet span or riveted construction. The very many long simple spans built by Geo. S. Morison fixed a type which has been very largely copied since.

SIXTH PERIOD, COMMERCIALIZATION

The sixth period (1900 to 1920) has seen a wonderful increase in the number of bridges built, but comparatively little news as to type of structure or in methods of construction. The most notable exceptions being the Hell Gate Arch already mentioned, and the Quebec Cantilever with its K system of trussing, as originated by Phelps Johnson. The methods of shop work have been perfected, and the latest specifications with regard to workmanship are marvels of explicitness. Methods of erection of simple spans, suspension bridges and cantilevers remains much the same as had been developed by the geniuses of the previou period.

The return to favor of the continuous bridge is due largely to the success of the Sciotoville bridge of two 775 feet continuous spans. There are several other notable examples all demonstrating the fitness of the type for any bridge of several spans, where the foundations are even reasonably unyielding. The span length of simple spans, has been extended to 721 feet in the Metropolis bridge over the Ohio River, and if occasion demanded the maximum limit could doubtless be extended to 1000 feet or over, but without the economy found in other types.

The competition among fabricating companies does not now exist in any considerable degree, such as required the designers of the previous period to seek for the most economical type and design of structure, and which resulted in a greater advancement than can likely be hoped for in any future similar period. The result is that more and more, at least in a greater percentage of cases, a bridge is "an example of what not to do."

The steel obtainable for fabricating bridges, has not become as highly uniform in physical qualities as could be desired or expected but in general it is better, due to the almost exclusive use of Basic Open Hearth material, in place of much Bessemer steel used during the fifth period. Then too, there is, under normal conditions, a greater use of nickel steel, and during the pre-war days there was every indication of its very wide use, as well as wide use of Silicon steel; and the probability that chronic vanadium steel having become of wide application in locomotive construction and other special uses, can soon be produced of a uniformity, in sufficient quantity, and at such a cost as will allow of its use in special bridge work, or more especially for long spans. The only hope for the continuance for many years of the building of long spans, will be through the possibility of a reasonable priced alloy steel of great and uniform strength, great ductility, and high elastic limit. Just how such a condition can be attained is beyond the possibilities of discussion here.

LIVE LOADS FOR RAILWAY BRIDGES

The evolution that has taken place in the Live Loads for Railway Bridges, can in some measure be judged by a study of bridge loadings, taken from a few of the representative specifications gathered by the writer during the past thirty-five years.

COOPER 1885	2—67T+2000 lbs. P. L. F.
	2—85T+2240 lbs. P. L. F. Approx. E. 22
	2—85.5T+3000 lbs. P. L. F. Approx. E. 24
P. LINES W. 1886	2—74.5T+32T cars (1640 lbs. P. L. F.)
1887	2—92.3T+32T cars (1640 lbs. P. L. F.)
1888	2—107.5T+4000 lbs. P. L. F.
KEYSTONE 1887	2—44T+1600 lbs. P. L. F. up to
	2—101T+3000 P. L. F. Approx. E. 30
PENCOYD 1887	2—905T+3000 P. L. F. Approx. E. 27
PHOENIX 1887	2—85.5T+3000 P. L. F. Approx. E. 24
BOUSCAREN 1887	30.000 lbs. Followed and Preceded by 3000 lbs. P. L. F.
1890	2—79T+2200 lbs. P. L. F. Approx. E. 22
	2—103.5T+3000 lbs. P. L. F. Approx. E. 30
	2—132T+4000 lbs. P. L. F. Approx. E. 40
THACHER 1893	2—107.5T+3500 lbs. P. L. F.
SOUTHERN RY. 1897	2—124T+4000 lbs. P. L. F.
P. LINES W. 1897	5000 lbs. P. L. F. — 50,000 lbs. Concen.
B. & O. R. R. 1896	2—125T+4000 lbs. P. L. F.
	or 100,000 lbs. on 2 axles 8 F. C. C.
1901	2—177.5T+5000 lbs. P. L. F. (E. 50)
COOPER 1901	2—177.5T+5000 lbs. P. L. F. Max. (E. 50)
1906	DITTO E. 50 Retained as Max.

A. R. E. A. 1906........COOPERS E. 40 Max.
1910........COOPERS E. 40 Max.
1920........E. 60 Spec. E. 70 Often used, and E. 70.
NIAGARA 1920.......E. 60 and E. 70 used in 1919
E. 70 or E. 75 Propos. 4 Trk.

The average increase (large dots) agrees well with the curve on Fig. 1, showing the increase in total weight of actual locomotives

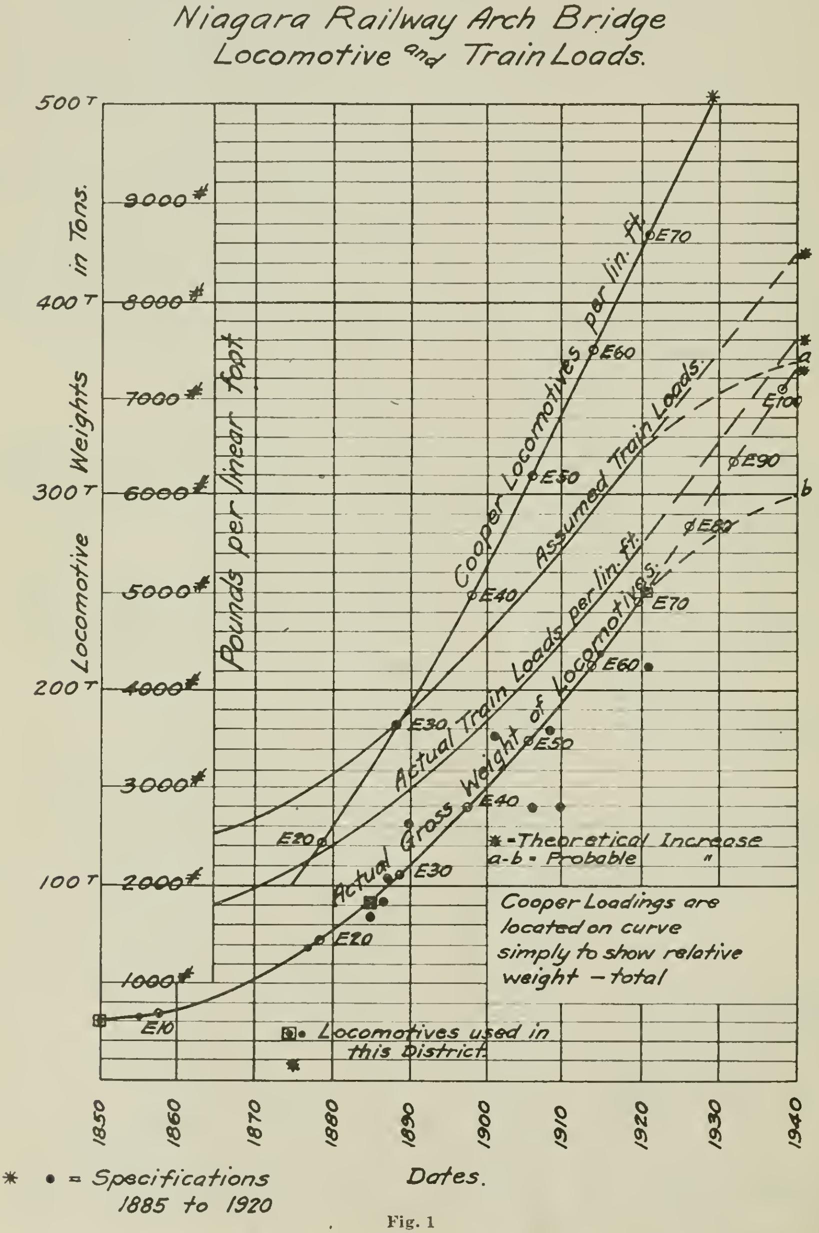
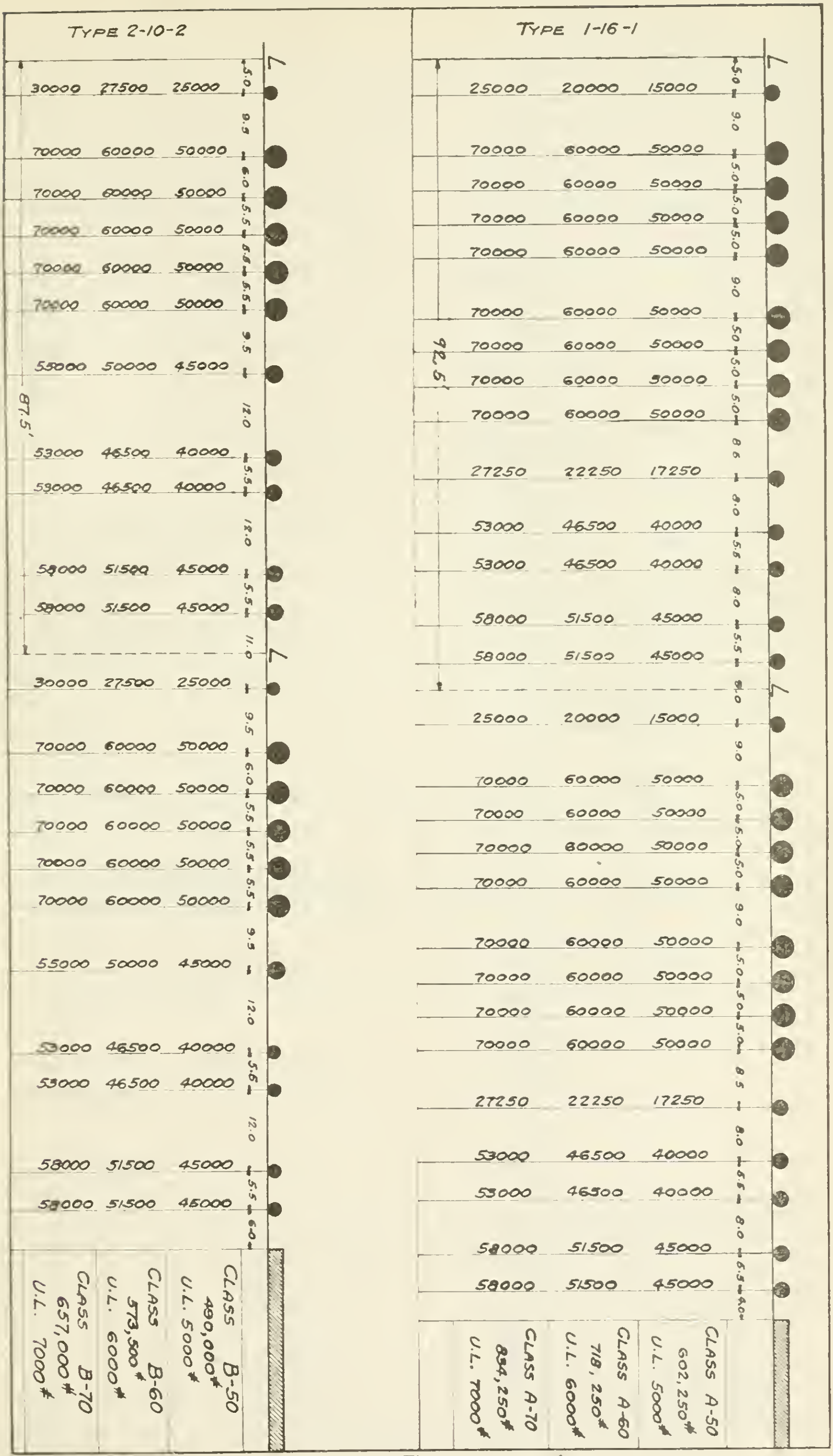


Fig. 1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55000 50000 45000
53000 46500 40000
53000 46500 40000
58000 51500 45000
58000 51500 45000
30000 27500 25000
70000 60000 50000
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55000 50000 45000
53000 46500 40000
53000 46500 40000
58000 51500 45000
58000 51500 45000
5.0 9.5 6.0 5.5 5.5 5.5 9.5 12.0 5.5 12.0 5.5 11.0
9.5 6.0 5.5 5.5 5.5 9.5 12.0 5.6 12.0 5.5 6.0
87.5'
CLASS B-50
490,000#
U.L. 5000#
CLASS B-60
573,500#
U.L. 6000#
CLASS B-70
657,000#
U.L. 7000#
TYPE 1-16-1
25000 20000 15000
70000 60000 50000
70000 60000 50000
70000 60000 50000
70000 60000 50000
70000 60000 50000
70000 60000 50000
70000 60000 50000
70000 60000 50000
27250 22250 17250
53000 46500 40000
53000 46500 40000
58000 51500 45000
58000 51500 45000
25000 20000 15000
70000 60000 50000
70000 60000 50000
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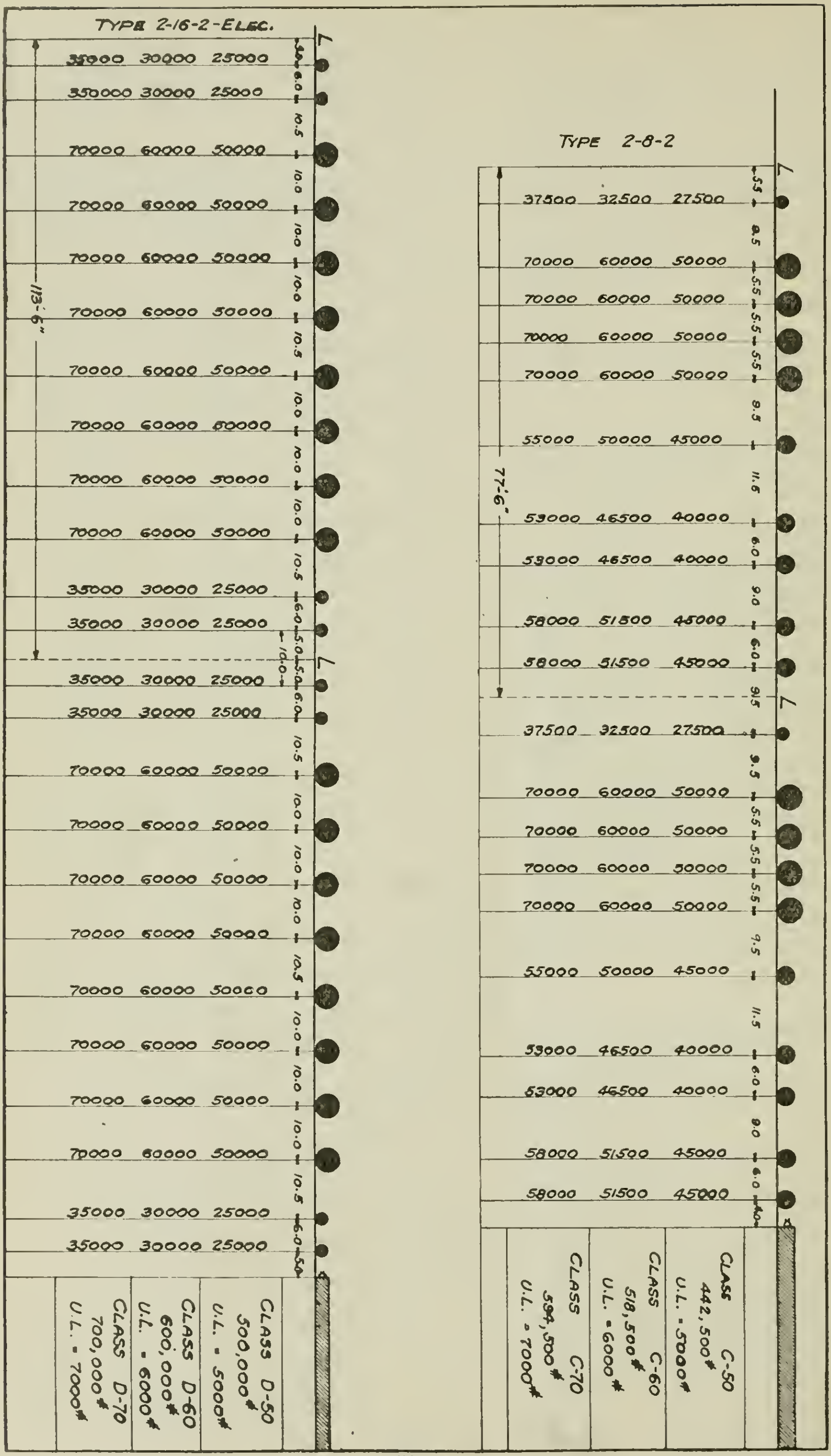
70000 60000 50000
70000 60000 50000
27250 22250 17250
53000 46500 40000
53000 46500 40000
58000 51500 45000
58000 51500 45000
5.0 9.0 5.0 5.0 5.0 9.0 5.0 5.0 5.0 8.6 8.0 5.6 8.0 5.5 8.0
9.0 5.0 5.0 5.0 9.0 5.0 5.0 5.0 8.5 8.0 5.6 8.0 5.5 6.0
92.5'
CLASS A-50
602,250#
U.L. 5000#
CLASS A-60
718,250#
U.L. 6000#
CLASS A-70
834,250#
U.L. 7000#

Fig. 3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350000 30000 25000
70000 60000 50000
70000 60000 50000
70000 60000 50000
70000 60000 50000
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70000 60000 50000
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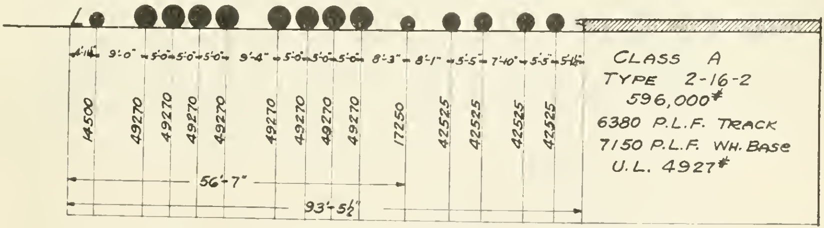
70000 60000 50000
70000 60000 50000
70000 60000 50000
70000 60000 50000
70000 60000 50000
35000 30000 25000
35000 30000 25000
113'-6"
5.0 6.0 10.5 10.0 10.0 10.0 10.5 10.0 10.0 10.0 10.5 6.0 5.0 10.0 5.0 6.0 10.5 10.0 10.0 10.0 10.5 10.0 10.0 10.0 10.5 6.0 5.0
CLASS D-50 500,000# U.L. = 5000#
CLASS D-60 600,000# U.L. = 6000#
CLASS D-70 700,000# U.L. = 7000#
TYPE 2-8-2
37500 32500 27500
70000 60000 50000
70000 60000 50000
70000 60000 50000
70000 60000 50000
55000 50000 45000
53000 46500 40000
53000 46500 40000
58000 51500 45000
58000 51500 45000
37500 32500 27500
70000 60000 50000
70000 60000 50000
70000 60000 50000
70000 60000 50000
55000 50000 45000
53000 46500 40000
53000 46500 40000
58000 51500 45000
58000 51500 45000
77'-6"
5.5 9.5 5.5 5.5 5.5 9.5 11.5 6.0 9.0 6.0 9.5 9.5 5.5 5.5 5.5 9.5 11.5 6.0 9.0 6.0 4.0
CLASS C-50 442,500# U.L. = 5000#
CLASS C-60 518,500# U.L. = 6000#
CLASS C-70 594,500# U.L. = 7000#

Fig. 4

used at Niagara from 1850 to 1919. The heaviest locomotives in use at the present time give moments for short spans considerably in excess of Coopers E. 70 loading, and this loading gives moments for long spans very much in excess of any trains in actual operation. That the present weight of locomotives is near the possible maximum limit, is proven by the fact that some roads have purchased locomotives of greater weight than is necessary for their traffic, than is good for their rails and road bed, and with greater tractive power than can be absorbed by the strength of the draft rigging on trains. Locomotive builders also have nearly reached their space limit as to size of cylinders and machinery for locomotives for standard gage railways. Considering all phases of the problem, it seems easily possible that the railway operators, bridge engineers, and locomotive builders, can now get together and decide upon limiting weights for each type of locomotive, so as to prevent a great future waste due to discarding otherwise good bridges on account of obsolesence.

The future maximum locomotive might be selected according to the schedule of typical locomotives, Figs. 3 and 4. The class A 70 to be the maximum of the mallet type; the class B 70 to be the maximum of the Sante Fe type; the class C 70 to be the maximum of the Mikado type; and the class D 70 to be the maximum of the Electric Locomotives. Then by plotting curves of the maximum moments and shears for these four types, or else by fixing upon equivalent uniform load curves, we could design our bridges so they would not be subject to obsolesence, but would only need renewal when actually worn out. For the purpose of comparison, two of the heaviest mallets so far built are shown, Fig. 5 being a Southern Pacific locomotive, and Fig. 6 a Pennsylvania locomotive, Figs. 7 and 8 are heavy electric locomotives, for the Milwaukee, and the Norfolk and Western respectively.



SOUTHERN PACIFIC NO. 4000
MALLET - 1909

Fig. 5

IMPACT ALLOWANCES

The evolution in regard to impact allowance, is shown by the following extracts from specifications from 1885 to 1920.

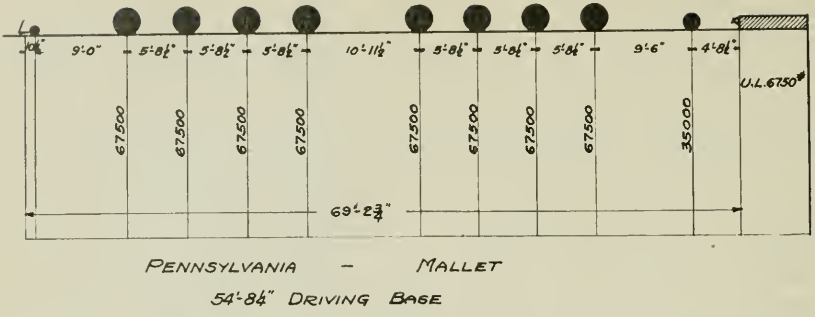


Fig. 6

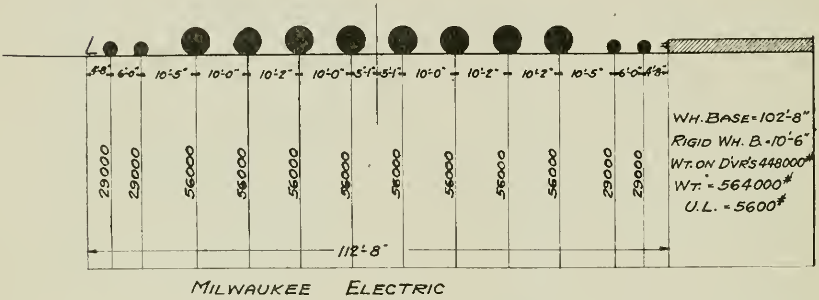


Fig. 7

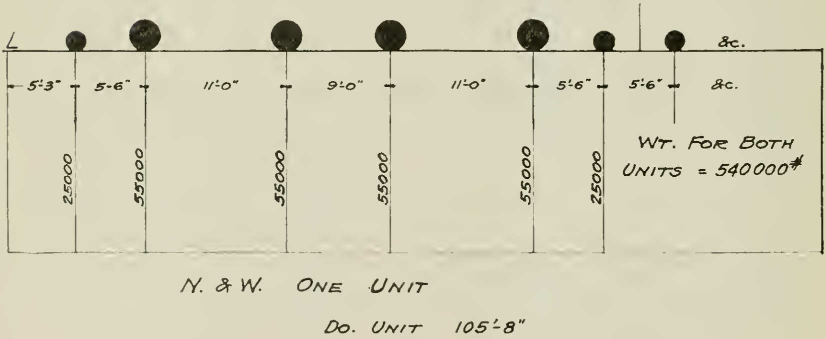


Fig. 8

COOPER 1885........ Percent of impact, spans above 150 ft. equals

$$\frac{150 \times \text{P. L. Stress}}{\text{D. L.} + \text{L. L. Stress}}$$

KEYSTONE 1887...... Launhardt formulas.

BOUSCAREN 1887.... Hangers 50% floor 25% truss members 10% to 20%.

P. LINES W. 1887..... From 20% for 30 ft. spans to)% for 150 ft. spans.

BOUSCAREN 1890... Hangers 2 ft. or less 100%. 2 ft. or more 50%. Cords and webs $\% = 50 \left(1 - \frac{d}{250}\right)$ D. = (Chds.) ½ span equals (Webs) distance of member from center of truss.

THACHER 1893.......Launhardt formulas.

SOUTHERN RY. 1897..$I = S \left(\frac{300}{L + 300}\right)$

P. LINES W. 1897.....Launhardt formulas.

B. & O. R. R. 1896......Launhardt formulas.

B. & O. R. R. 1901......$I = S \left(\frac{300}{L + 300}\right)$

COOPER 1901..........L. L. Unit Stress ½ D. L. Unit Stress.

COOPER 1906..........L. L. Unit Stress ½ D. L. Unit Stress.

A. R. E. A. 1906.......
1910....... $I = S \left(\frac{300}{L + 300}\right)$

1920 ....$I = S \left(\frac{300}{300 + \frac{e^2}{100}}\right)$

This schedule represents in the main simply successive increases in approximations, and none are true scientific deductions from the data now available. The final impact formula must have factors for variation in speed, for critical speed, for panel lengths, and any other factors that are found to influence the result. There is quite surely data enough from which to construct such a formula, but unless one of our engineering societies decides to make a serious effort to frame the ultimate specifications, it seems probable that we may soon get such a formula from far off India.

UNIT STRESSES

The unit stress for the same period as that used for Live Loads and Impact are shown in the following schedule, first for tension unit stresses and then for column formulas.

COOPER 1885........ Bars 10000 lbs. square in. shapes 8000 sq. in.
(Iron) .... Hangers, Bars 6000 lbs. shapes 5000 lbs.

KEYSTONE 1887......Iron 7500 $\left(1 \text{ plus} \frac{\text{Min. Stress}}{\text{Max. Stress}}\right)$
Steel 10500 $\left(1 \text{ plus} \frac{\text{Min. Stress}}{\text{Max. Stress}}\right)$
Hangers, Iron 7000 lbs. steel 10000 lbs.

PENCODY 1887.......	Iron Bars 15,000 lbs. Shapes 14,000 lbs. Steel Bars 18,000 lbs. Shapes 18,000 lbs.
BOUSCAREN 1887.....	Steel 14,000 lbs.
P. LINES W. 1887.....	Iron Bars Chords and Diagonals. Less than $4\frac{1}{2}$ sq. in. 10,000 lbs. More than $4\frac{1}{2}$ sq. in. 9,000 lbs. End suspenders 8,000 lbs. Hangers 5,000 lbs.
P. LINES 1887.........	Iron U (1 plus $\frac{\text{Min. Stress}}{\text{Max. Stress}}$) U equals 7,500 lbs. double roll iron. U equals 7,000 lbs. plates and shapes.
PHOENIX 1887.......	Iron Main Bars 10,000 lbs. Verticals and Counters 8,000 lbs. Hangers 7,000 lbs. Steel Main Bars 13,200 lbs. Verticals 10,000 lbs. Counters 10,500 lbs. Plate Hangers 9,000 lbs. Spans over 200 ft. Chords & Diagonals 10,000 (1 plus $\frac{\text{Min. Stress}}{\text{Max. Stress}}$
BOUSCAREN 1890....	Iron still provided for. Steel tension 14,000 lbs.
THACHER 1893.......	Iron still provided for. Steel bars 9,400 (1 plus $\frac{\text{Min. Stress}}{\text{Max. Stress}}$) Hangers 6,600 lbs.
SOUTHERN RY. 1897..	Steel 17,000 lbs. sq. in.
P. LINES 1897.........	Iron Bars 7,500 (1 plus $\frac{\text{Min. Stress}}{\text{Max. Stress}}$) Shapes 7,000 (1 plus $\frac{\text{Min. Stress}}{\text{Max. Stress}}$)
B. & O. R. R. 1896......	Steel 9,000 (1 plus $\frac{\text{Min. Stress}}{\text{Max. Stress}}$)
1901......	Steel 17,000 lbs. sq. in.
COOPER 1901..........	Steel L. L. 10,000 lbs. D. L. 20,000 lbs. Hangers 6,000 lbs.
COOPER 1906.........	Steel L. L. 10,000 lbs. D. L. 20,000 lbs. Hangers L. L. 8,000 lbs. D. L. 16,000 lbs.
A. R. E. A. 1906.........	Tension 16,000 lbs. sq. in.
1910.........	Tension 16,000 lbs. sq. in.
1920.........	Tension ...... lbs. sq. in.
NIAGARA 1919........	Tension Bars 22,000 lbs. Shapes 20,000 lbs.

The last item for Niagara represents a step towards what must be the ultimate goal, when full impact and full secondary stresses have been included in the total stresses, so that there are in effect static stresses only to be provided for; and when the assumed live load has become the ultimate possible, we can safely approach the elastic limit very closely for our unit stresses. There will then be no excuse for any large excess of steel in an entire bridge or in any considerable portion of any future span.

COLUMN FORMULAS

COOPER 1885.........Iron pin ends $p=\cfrac{8{,}000}{1 \text{ plus } \cfrac{l^2}{20{,}000\ r^2}}$

KEYSTONE 1887......Steel pin ends $p=15{,}000—80\ \frac{l}{2}$

PENCOYD 1887........Steel $p=\cfrac{18{,}000}{1 \text{ plus } \cfrac{l^2}{10{,}000\ r^2}}$

BOUSCAREN 1887.....$l \div r$ less than 50. 12,000 lbs.
Greater than 50 pins $p=\cfrac{18{,}000}{1 \text{ plus } \cfrac{l^2}{18{,}000\ r^2}}$

P. LINES W. 1887......Iron pin ends $p=8{,}400—84\frac{l}{r}$

P. LINES 1887.........Iron pins $p=\cfrac{6{,}500\ \left(1 \text{ plus } \cfrac{\text{Min. Stress}}{\text{Max. Stress}}\right)}{1 \text{ plus } \cfrac{l^2}{18{,}000\ r^2}}$

PHOENIX 1887.......Iron, pin ends $p=\cfrac{7{,}800}{1 \text{ plus } \cfrac{l^2}{3{,}000\ r^2}}$
Steel—iron value X1.33 when in excess of 13,200 lbs.

BOUSCAREN 1890....Steel pin ends 12,000 lbs. when $\frac{l}{r}$ less than 50.
$\frac{l}{r}$ greater than 50 $p=\cfrac{9{,}000}{1 \text{ plus } \cfrac{l^2}{18{,}000\ r^2}}$

THACHER 1893.......Steel, pins $p=11{,}000—570\ \frac{l}{r}$ l in feet.

SOUTHERN RY. 1897. . Steel, pins $p=18{,}000-90\frac{l}{r}$

P. LINES 1897. . . . . Iron, pins $p=7{,}000-70\ \frac{l}{L}$
L=depth open box section.

B. & O. R. R. 1896. . . . Steel, pins $p=9{,}000\ (1 \text{ plus} \frac{\text{Min. Stress}}{\text{Max. Stress}} -53\frac{l}{r}$

B. & O. R. R. 1901. . . . . . Steel, pins $p=\frac{17{,}000}{1 \text{ plus } \frac{l^2}{11{,}000\, r^2}}$

COOPER 1901. . . . . Steel chords $LL=10.000-45\ \frac{l}{r}$
1906. . . . . $DL=20{,}000-90\ \frac{l}{r}$
Posts $LL=8{,}500-45\ \frac{l}{r}$
$DL=17{,}00-90\ \frac{l}{r}$

A. R. E. A. 1906. . . . . . .
1910. . . . . . . Steel, pins $p=16{,}00-70\ \frac{l}{r}$
1920. . . . . Steel, pins p=

NIAGARA 1919. . . . . Steel, pins $p=23{,}000-100\ \frac{l}{r}$
p max. equals 20,000 lbs.

The column formulas given are for the Fifth and Sixth periods, and are remarkable in their showing as to how pertinaciously the Gordon formula hung on into the sixth period. Some of those who were so insistent upon its use, still hold that we must return to it, and the writer leans to the belief that it most likely will very closely represent the facts, when we have obtained them from a review of the great mass of column tests, if we ever have the courage and finances to tackle the job. The straight line formula, however, con be so taken as to be safe, not too wasteful, and certainly it is easier to apply. With all stresses included and the total a static value, the Niagara formula is abundantly safe; but as in the case of tension unit stresses, we may eventually go much higher, if more attention is paid to proper column detailing.

SEVENTH PERIOD, WHAT OF THE FUTURE?

When we passively rest where we are, in full satisfaction that what we have is good enough, one may be sure of an eventual retrogression, at least in effect, as there is something better that is easily obtainable, if we keep constantly striving for advancement similar to what we can discern in our study of the periods prior to the last. Where are we to look for leadership? Who will be a leader of the type of Marburg, who gave us such a wonderful set of material specifications?

Can the writer hope that this short study of the "Evolution of Bridge Design" will be placed in the hands of the students of structural engineering, each year and everywhere, to instill into their minds that theirs is a profession with a notable past, and for which a great future is possible?

Will they perceive from a study of this evolution, period by period, that there is an anatomy of bridges that they must know in its fullness if they would construct sound bridges, or seek to cure relatively strong existing ones; as was done at Niagara, and as can be done with numerous bridges of many types?

Will the teachers in our colleges endeavor to teach this anatomy, and also the aesthetic possibilities for bridges? Will our college authorities arrange at least a semester period on the History of our bridges, covering particularly their anatomy; and a semester period on architecture for the engineer? Let us break away from the strictly commercialized engineering we are teaching in our schools, as well as holding to in our practice, and climb again towards those heights of science and art which means true achievement.

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Get the

Noon- Day Luncheon Habit

By hearing

Dr. George W. Vincent

President
Rockefeller Foundation

on

A Subject of Considerable Interest to Engineers

Saturday, December 11th., 1920

Cameo Room - - - Morrison Hotel

Lunch 1:15 P. M.---Tickets $1.00

Dr. Vincent has a nation-wide reputation as an unusually effective speaker and educator. His work at the University of Chicago and more recently as President of the University of Minnesota has put him in the front rank of the Nation's public men. In his present work with the Rockefeller Foundation he has the opportunity of studying from an exceedingly broad standpoint.

On account of Dr. Vincent's many engagements it is necessary to schedule on Saturday at 1:15 p. m.

Dr. Vincent is a "headliner."

Be sure to hear him.

CURRENT NEWS SECTION

JOURNAL OF THE
WESTERN SOCIETY of ENGINEERS

Volume XXV DECEMBER, 1920 Number 16

U. S. Senate Committee on Re-construction

Senator Wm. M. Calder, Chairman, invited the Western Society of Engineers, to present information to his committee at the hearings held at the Auditorium Hotel, November 10 and 11. At this hearing, representatives of the Engineers, Architects, Manufacturers, Contractors, Bankers and all other industries connected with re-construction were invited.

Mr. Frank D. Chase, M. W. S. E., represented the Western Society of Engineers.

Mr. Chase said:

I am here as the representative of the Western Society of Engineers, an organization of 3,000 members, representing fully the profession in the Middle West, in its manifold activities. I am here in lieu of Mr. F. K. Copeland, President of the Western Society of Engineers, who asked me to take his place. He approves of what I say—and, incidentally, I promise to be brief.

We are here to discuss the building situation in its local aspects, as we know them, and although I am an Engineer, and very proud of it, I have no formulate to elucidate—on the contrary I shall speak briefly and simply of one law.

This entire situation is the result of the operations of an immutable law, and the operation of this law will continue to control the situation. I refer to a law which executive or legislative enactment has attempted to repeal several times during the past years with disastrous results. As a law making body you will do well to consider this law in connection with the fact that it is not a lack of laws but a lack of law enforcement which hurts this nation sorely—I refer to the law of supply and demand.

This is the law which can never be repealed in spite of efforts to do so, and our present problem lies within its jurisdiction.

There is nothing mysterious about this situation, nor is it extremely complex, as some people would have us think. For six years we have been building one class of buildings to the exclusion of all others. Industrial plants have been built at a rate which has, in my opinion, not quite kept up with the growth of the country. There are good reasons for this statement, which I shall omit. The indications are unquestionably that manufacturing plant construction must continue and on a large scale.

All other kinds of buildings, homes, apartments and hotels, institutional plants, including churches, theaters, hospitals, colleges, schools, clubs and municipal, state and government buildings, mercantile buildings, including stores, shops, warehouses and office buildings, have not been built to meet the demand, for these years, and to make good this deficiency will require between five and eight years. This allows for an excess over normal construction of only 12½ to 20 per cent and is the base on which many large corporations, after careful analysis, are developing their future plans and policies.

These figures do not apply to the housing problem. These housing requirements specifically, and our building requirements generally, are going to be met and in a simple fashion.

For five years this country has prospered, but it has been cursed too, by war—war is merely hate and fear and greed in action, and we have had war here as truly as in Europe. Men have fought for unfair advantage and profit, with fear that they would lose material gain, and with greed of possession. This is true of us as a nation—to our shame—and applies to the laborer, mechanic, clerk, merchant, manufacturer, banker, the man who works with hand or brain—all have been alike guilty. This war has been fought for bigger profits, or bigger wages, with the attendant evils of stealing time, shirking duties—all summed up in one word "profiteering."

This is the cause of railroad troubles, car shortage, motive power shortage, strikes, jurisdictional troubles, reduction of output, restrictive labor and trade understandings, and all the other evils of the past years.

This war is over and we are back on our old basis of decent Americanism. This means, as never before, the square deal, as preached and practiced by Theodore Roosevelt.

When profiteering is over, we are going to have labor to build with, and labor will be paid an honest wage, which is all it asks, and it will give an honest day's work, which it has given in the past.

When profiteering is over, materials will be available only in quantities which will permit us to catch up with our buildings in a number of years, as I before said. This demand will make for reasonable profits, no more. I am in close touch with a good many industries throughout the country and I observe that the industries which profiteered the most are now suffering the most.

When profiteering is over, money to finance building operations will be forthcoming. There is always money for legitimate enterprises, at a legitimate price. Certainly the cost of money cannot be controlled by legislation. That has been tried on a large scale of late years, rather unsuccessfully. I do not believe that it is necessary for our government to finance local building projects. The American city is a wondrous thing, and Chicago I know has never failed in what it has undertaken.

This period of liquidation is neither pleasant nor easy, but it certainly has no elements of panic or destruction. It is being solved. I daily talk with the executives of large industrial enterprises, and I note the steps taken to solve the individual problems, which after all, go to make up the nation's problems.

The great Engineer, Herbert Hoover, helped as perhaps no other one man helped to win the war through his food control and his most powerful weapon was publicity.

I have one definite recommendation to make—that if we can have publicity and the truth regarding all the facts effecting this building situation, in every community, then there would be little fear for the future. A million dollars should and could be raised in Chicago and proportionate amounts in other cities for a publicity bureau, for the publication of all the facts regarding building operations. Such a bureau might not be popular with some people, but it would certainly enable us to act intelligently.

I repeat in closing—I have advanced no theories, given no statistics nor attempted any intricacies of reasoning. I ask only that this situation be met on a basis of good will and good faith, coupled with sound common sense and freedom from hysteria and misrepresentation.

The profit is gone from the profiteer. As Americans we are back on the basis of honest regard for honest endeavor, and if we let that fundamental law of supply and demand operate, and make the results of its operation known through honest publicity, we shall, without undue stress, solve this problem which confronts us.

Noon-Day Luncheon—November 12th, 1920

Mr. E. J. Mehren, editor of the Engineering News Record, New York, was the speaker at the November Noon-Day Luncheon.

Mr. Mehren stated the most disheartening of political developments in Europe is the rift between England and France. England stands for a policy that will favor German rehabilitation; France is trying to insist on very rigid enforcement. There is disagreement, too, regarding policy toward Russia. England believes that commercial relations are desirable (though in the last two months she has not pushed the point); France insists that there shall be no business dealings, but that Russia's enemy, Poland, shall be supported. On these two questions there has been a steady divergence between the two great allies, and thoughtful men in England feel that it is inevitable that the two powers cannot permanently work together. It is not expected that there will be hostility, but that France and England will go in different directions in dealing with the big questions of Europe. Those questions, for the present, necessarily relate to Germany and Russia.

Equally disconcerting is the attitude of other European countries toward France. In fact, it is within the truth to say that France is alienating herself from all the rest of Europe. The antagonistic attitude of Germany is well known—and, in view of French policy since the Armistice, to be expected. Italy is jealous because France has been alloted so large a proportion of the indemnity. Holland believes that she is intoxicated by her victory. Only Belgium seems friendly, and there the Flemish party is chary of too close an alliance with France.

Industrially, Belgium and France have made good progress. France in her May-day strike met the test of Bolshevism. She proved to the satisfaction of all classes that the French worker would have no part with Bolshevism, and preferred to work out his salvation under the present method of social organization.

England has a difficult labor situation on its hands. Labor is aiming to bring about a nationalization of the coal-mining, transportation and electric-generating industries of Great Britain. Competent observers believe that there will be much serious labor trouble before there is stabilization.

Germany's rapid progress, so much heralded late last year, has received a set-back. Because of high prices, both domestic and export buying have fallen off. However, German industrial leaders, scientists and engineers are addressing themselves with tremendous energy and extraordinary intelligence to the rehabilitation of industry, and with adequate credits, Germany, despite her war debt, should be able to work out her salvation. It will take long merely because she has so very far to go—her war debt is so stupendous. Her old virility, however, is latent and needs only credit and production—with their accompaniment of better food and living conditions—to put her on a start upward grade.

Mr. Mehren has recently returned from a four months' study of the industrial conditions in Europe. He proved himself a close observer of these conditions and his address was full of interesting information and inspiration to the 300 members and guests of the Society who attended the luncheon.

Mr. J. H. Libberton, chairman of the Noon-Day Luncheon Committee, presided and introduced Mr. Andrews Allen, Chairman of the Public Affairs Committee, who devoted ten minutes to explaining the work of his committee.

Seated at the speakers' table were representatives of the editorial staff of the Technical and Trade Journals of Chicago and vicinity.

The next Noon-Day Luncheon will occur December 11th, 1920. Dr. Geo. E. Vincent, president, Rockefeller Foundation, will be the speaker.

Committee Notes

Twenty-three committees are actively at work in our Society. From time to time progress reports will be published in our Journal.

The Amendments Committee is charged by the Constitution to receive suggestions of changes in the constitution and make recommendations to the Board of Direction and the Society, on or before the first regular meeting in March. The members are requested to submit proposed changes now.

The Excursion Committee has plans for an excursion to the University of Illinois, also to South Bend, Indiana. Short inspection trips are also being planned.

The Development Committee is preparing a set of questions regarding the work of the Society, which will be sent to the members shortly. It has taken considerable thought to prepare even a set of questions. Do not fail to give a thoughtful answer.

The Terminal Committee has made considerable progress in outlining a line of study for this winter. The plan is to sub-divide the Terminal conditions in Chicago by assigning subjects to members. Later the reports will be received and discussed by the committee. Probably no more important matter is before Chicago than Terminals. If you want to get in on these discussions, notify the secretary.

The Public Affairs Committee is now assigning new subjects to the Sub-Committees. This committee meets each Monday noon (12:30) at the Chicago Engineers Club.

You are invited to meet with this committee at any time.

Mr. PenDell, the Chairman of the Increase of Membership Committee, plans considerable activity this winter. Applications for membership are coming in from all over the United States, and recently we have had inquiries from India. Chicago is our field, however, and there are still a thousand or two who are not members of the W. S. E. You probably know some of them—if so send in their names. The Committee will appreciate your help.

The Military Committee has recommended that steps be taken to secure a U. S. Armory in Chicago, to be located near the Municipal Pier.

The Committee has also prepared a Questionnaire in order to know the views of the Membership on Preparedness. You will receive this shortly.

The Committee wants to know what you are willing to do also.

The Publication Committee wishes to make the Journal pay its own expenses —the two dollars set aside from your dues will not do it now, with printing costs as high as they are. By increasing the revenue from advertising the Journal can be improved without being a financial load on the general funds of the Society.

The advertiser wants to know what the reader buys. In order to answer this question the committee is sending a set of questions to each member. Please give this your prompt attention.

The Student Branch Committee will have an interesting report shortly. This committee considers that our Society has a large responsibility in their matter. They are now making complete study of the field.

The work of the Membership Committee has been very heavy this year. It is no small matter to carefully consider the qualifications of the applicants and make the proper recommendations. Sometimes it has happened that delays by members in not returning the reference blanks has prevented prompt consideration. It is quite important that the committee know fully why the man should be accepted or rejected.

NOON DAY LUNCHEON

J. H. LIBBERTON, Chairman.

"An Engineer's Impressions in Europe" was the subject of Mr. E. J. Mehren's address at the Noon-Day Luncheon, held November 12th, at the Morrison Hotel. Mr. Mehren is editor of the Engineering News-Record and he reviewed existing industrial, political and social conditions. Mr. Mehren's clear analysis gave the members new facts.

Seated at the speakers' table were representatives of technical publications in Chicago and also John Fletcher, Chairman of the Ways and Means Committee of the Association of Commerce. He was a specially invited guest. Andrews Allen, Chairman of the Public Affairs Committee of the Western Society of Engineers, reported for his committee.

Announcement was made of the next Noon-Day Luncheon meeting to be held at the Morrison Hotel, Saturday, December 11th, 1920, at 1:15 p. m. In order to secure Dr. Vincent as a speaker it was necessary to schedule the Saturday meeting.

Dr. Vincent's nation-wide reputation as an unusual speaker will no doubt bring out a large attendance. Dr. Vincent's work at the University of Chicago and more recently as President of the University of Minnesota has put him in the front rank of the nation's public men. In his present work with the Rockefeller Foundation, he has the opportunity of studying conditions from an exceedingly broad standpoint.

Every member of the Western Society of Engineers who has ever heard Dr. Vincent will no doubt arrange to be present.

Such a talk as Dr. Vincent will give will be worth every engineer's Saturday afternoon.

In order that we may have a large engineer for the Los Angeles County audience for Dr. Vincent, it is urged that all members of the Western Society of Engineers make it a point to attend.

The date is Saturday, December 11th, 1920, 1:15 p. m. (not 1:15 a. m. as stated in the November issue of the Journal).

YOUNG MEN'S FORUM

BENJAMIN SHAPIRO, Chairman.

The increased attendance at the Saturday afternoon meeting on November 13th, when Mr. W. H. Fogerty of the Alexander Hamilton Institute addressed us on the "Right Habits of Mind," indicates a deep interest in this new feature of Society activities. Mr. Fogerty demonstrated very clearly how susceptible the mind is to careful training.

"What to Read," "How to Read," and "How to Apply Reading" is largely an engineering problem because it requires an analytical mind, tho frequently the problem remains unsolved due to mental inertia, a thing fortunately that is not generally inherent in the Engineer. Mr. Fogerty was for many years connected with "Engineering and Contracting," and has a broad view of the Engineer's temperament.

On Saturday afternoon, December 18th, at 1:30 o'clock, Mr. O. M. Fox, Western Manager, Business News Dept., of the "Engineering News-Record," will address the Young Men's Forum on the "Enconomics and the Engineer." Clients depend on Engineers for advise as to when to build as well as how to build. Elementary economic knowledge is as essential as advanced technical knowledge.

All members of the Society are invited to be present and participate in the discussion.

ENTERTAINMENT COMMITTEE

A. B. BENEDICT, Chairman.

LADIES' NIGHT

If you were not one of the happy members to attend the most successful, strictly sociable meetings the Western Society of Engineers has ever had, you missed something.

Altho our Assembly room was crowded Friday evening, November 5th, there was still room for more. The ladies of course made the evening a success and we are quite proud of the large attendance.

Both the old and new members were present and enjoyed the dancing, cards, movies and refreshments. But it was too short. Nobody wanted to go home. The music was ideal, the floor excellent and for that reason everybody would gladly have stayed two hours more.

The Entertainment Committee certainly deserves the thanks of every member for making this meeting such a wonderful success. We hope that they make these Ladies' Nights more frequently and if they do, we know that all those who were here will be sure to attend. We suggest that those who were not able to be at the last one, see that they get in on the next big time.

Watch for the Entertainment Committee's announcement, because when they promise you a good time you will certainly have one.

PUBLIC AFFAIRS COMMITTEE

NON-PARTISAN NIGHT

Altho election is over now and we have something else to think about, besides Political questions, at the time this meeting was held, Friday, October 29th, such was not the case.

The Public Affairs Committee should certainly be complimented on the excellent speakers and program they arranged for this meeting.

Can it be that engineers do not like to have the other side of the argument presented, or was it that you were attending a meeting in your immediate neighborhood, for there certainly is an apology due the Public Affairs Committee, for the scant attendance at this meeting.

The Public Affairs Committee firmly believes the engineers as a profession are interested in elections and should be well versed and broad thinking in all lines. With this in view, they got up this most excellent program, but which received such slight response from our members and friends.

MATERIALS AND METHODS COMMITTEE

Mr. F. K. Copeland, President, has announced the appointment of Mr. F. J. Postle, as a member of the Joint Professional Committee, for Materials and Methods, in the place of Mr. J. R. Cravath, resigned.

The work of this committee is very important and jointly with architectural societies, considerable progress is being made in a revised building code for Chicago.

LIBRARY SERVICE

MISS ELTA VIRGINIA SAVAGE, Librarian

The following books have just been purchased and placed in the Western Society Library for your use:

Rogers, Allen, ed.
Industrial Chemistry, 3d ed. 1920.
Cunningham, Brysson,
Treatise on the Principles and Practice of Harbour Engineering, 2nd ed. 1918.
Bullens, D. K.,
Steel and its Heat Treatment, 2nd ed. 1918.
Lauer, Henri and Brown, H. L.,
Radio Engineering Principles, 1920.
Fowler, C. E.,
Practical Treatise on Sub-Acqueous Foundations. 3d ed. 1914.
Westcott, H. P.,
Handbook of Natural Gas. 3d ed. 1920.
Somermeier, E. C.,
Coal, Its Composition, Analysis, Utilization and Valuation. 1912.
Lockhart, L. B.
American Lubricants From the Standpoint of the Consumer. 2nd ed. 1920.

Through the generosity of members a number of books have been received.

Prof. F. E. Turneaure, Dean of the College of Engineering, University of Wisconsin, has presented us with the third edition of "Principles of Reinforced Concrete Construction," by F. E. Turneaure and E. R. Maurer.

"Building Estimators' Reference Book," was placed in the Library by J. N. Hatch.

I. F. Stern added two books of historical interest—an 1888 edition of Wegmann's "Design and Construction of Masonry Dams," and Buck's "Essay on Oblique Bridges," 1895.

S. O. Andros, editor of Oil News, has made available for the membership, a copy of his new book "Fuel Oil in Industry."

W. J. Karner, Secretary and Treasurer of Bowne & Co., 161-167 Maiden Lane, New York City, has made a gift of six volumes of the Canal Record.

W. D. Gerber dropped in the other day and left a copy of the Report of the Columbia Basin Survey Commission.

The editors of the Plumber and Steam Fitter and Sheet Metal Worker are cooperating with us by sending the magazine for our files.

National Safety News, published by the National Safety Council, is now in our files.

During the past month the Library has had inquiries regarding canal locks, hoisting machinery, mining engineering, electric furnaces, steam turbines, inductive interference, dams, contract forms, water power development, iron and steel prices, climate, ice making, sewage, inland waterway transportation, soldering, spraying paint, railway embankments, coal breakage, screw piling, hydrated lime, cold rolled steel, barge construction, petroleum refining, towing machinery, porcelain insulators, water from tar emulsion, pulverized coal, lightning, foundation soils, permanent magnets, elevations, heat transmission, chemistry of glue, dock construction, shop management, waterworks for small cities, highway bridge design, conveyors for foundries, breakwaters, lignite, cofferdams, gas plant construction, ice houses, heavy power transmission lines, refrigeration, oil as fuel, lathes, electrification of railroads, warm air heating, welding, open hearth steel, coal mine refuse, telephones, phosphorus in iron and steel, millwrighting, sherardizing, etc., etc. Our resources have been taxed to the limit in trying to care for these varied inquiries.

Through the courtesy of some of our members we have been able to furnish valuable clues and, in many cases, to give the exact information. However, our advisory staff is still incomplete. Won't you join this advisory staff and let us know for what assistance we can count upon you?

The Library is ready to dispose of a number of sectional book cases (Globe-Wernicke).

This is a good opportunity to obtain additional shelving space in your office at a reasonable figure.

Book Review

Mr. MONTFORD MORRISON reviews "Radio Engineering Principles," by HENRI LAUER, formerly Lieutenant Signal Corps, U. S. A., assistant in the preparation of training literature on radio theory and equipment, and HARRY L. BROWN, formerly Captain Signal Corps, U. S. A., in charge of preparation of technical training and literature used in Signal Service.

"This book contains a great deal of information concerning recent progress, some of which is not to be found elsewhere in book form.

"It is recommended to be reviewed by all those interested in radio principles.

"In reality the book would ordinarily be called 'A Sketch of Radio Principles Including Recent Advances During the War Period.'

"The word 'Engineering' is usually thought of as relating to construction with reference to its numerical computation, whereas the book in question does not cover this field, and only discusses computation in a general sense relating to principles. For instance, J. A. Fleming's book on the 'Principles of Electric Wave Telegraphy and Telephony' treats the subject matter of this book in a much more complete and broader way, even with particular reference to the mathematical side of the problems.

"This book has the unfailing characteristic which is common to a great many books, in that it contains subject matter which is so much more adequately treated elsewhere that it seems useless to include it. For instance, the first two chapters on 'Electrical Theory' and particularly the chapter on 'Properties of Oscillatory Circuits,' containing discussions of differential equations, as are found on pages 48-49, are either very well known to the reader from books published twenty years ago, or they are entirely incomprehensible to the reader.

"In other words, if the reader did not already know the equations, he would not be prepared to understand them from their discussion. Equations, which are so adequately and so systematically treated in, for instance, 'Alternating Currents,' by Bedell and Crehore, published in 1901, should be left out.

"The descriptive matter on Vacuum Tubes, concerning their operation, characteristics and uses, is good.

"But it is rather surprising that since higher mathematics were utilized in the discussion on oscillatory circuits, that wave propagation and vacuum tubes were not similarly treated, as these two latter mentioned subjects permit of quite elaborate detail in their mathematical discussion.

"In spite of this I wish to mention again that those interested in recent progress of radio principles should by all means review the book."

M. M.

Notes on Speakers

Mr. E. J. Lowry, metallurgist, Oliver Chilled Plow Works, South Bend, Indiana, will present a paper on "Practical Malleable Annealing."

Mr. Lowry has for many years made a study of malleable iron and stands very high in the profession.

Mr. H. R. Allensworth, is Consulting Appraisal Engineer for the Tri-State Telephone and Telegraph Company.

His paper on the "Influence of Commodity Price Movement upon Public Utility Valuations," will be presented December 9th, 1920.

Mr. R. C. Marshall, Jr., is now the General Manager of the Associated General Contractors. During the war as head of the Construction Division, U. S. Army with the rank of Brig. General, he did wonderful work. His knowledge of "Contracts' is as wide as his personality is strong.

He will speak before the Society in February.

H. C. Boyden is a member of the American Society of Civil Engineers, also is Lieut. Col. in the U. S. Engineers Officers Reserve Corps. As Major of Engineers he was Instructor in Roads and Pavements at the Engineers' School, U. S. Army, Camp Humphreys, Va.

He is a graduate of Worcester Polytechnic Institute and has been engaged in various engineering work for the past twenty-five years. Much of this time has been spent on the engineering staff of the Boston & Albany, New York Central & Hudson River, Delaware, Lackawanna & Western, and Atchison, Topeka & Santa Fe Railroads, also with the U. S. Reclamation Service on the Roosevelt Dam and the Granite-Reef Dam. In addition he has been resident Highway Commission and the California State Highway Commission. He has done much consulting engineering work and valuation of public utilities. Lieut. Col. Boyden's engineering connections have included the design and construction of structures involving the use of between 400,000 and 500,000 cubic yards of concrete.

Col. Boyden will speak December 13th on "Recent Developments in Concrete."

The meeting for December 6th will be held under the auspices of the Aviation Committee.

J. F. Hayford, Director of the School of Engineering, Northwestern University, is Chairman.

Prof. Hayford is a member of the Advisory Committee on Aeronautics, U. S. Navy and during the war has been very active in the Engineering of Aeronautics.

Mr. A. R. Rhenisch, Consulting Engineer, Chicago, and secretary of the Aero Club of Chicago, will speak on the "Recent Progress and Cost of Commercial Aviation."

Mr. Walter Painter, will speak on "Commercial Airplane Types." Mr. Painter was flying in France during the war. From his experience and study he will present some interesting data.

December Meetings

Dec. 6th—General Meeting.
"The Commercial Use of the Airplane." Speakers: J. F. Hayford, A. R. Rhenisch, Walter Painter.
Dec. 9th.—Telephone and Telegraph Engineering Section.
"The Influence of Commodity Price Movement Upon Public Utility Valuations." H. R. Allensworth.
Dec. 17th—Electrical Engineering Section. Joint with Chicago Section, A. I. E. E.
"The Present Tendencies in Electrical Railway Development and Available Means of Improvement." Speakers:
H. A. Johnson, Organizing Engineer, Chicago, North Shore & Milwaukee Electric Railway.
S. B. Way, Vice President and General Manager, Milwaukee Electric Railway & Light Company.
Charles H. Jones, Electrical Engineer, Chicago, North Shore & Milwaukee Railway.
Dec. 20th.—Hydraulic, Sanitary and Municipal Engineering Section. Subject to be announced.

Personals

Mr. Langdon Pearse, M. W. S. E., Chief Sanitary Engineer, Sanitary District of Chicago, was chairman of the committee on Sanitation at the Health and Sanitation Exhibition, held at the Coliseum, November 24th to 29th.

Mr. Burton J. Ashley, M. W. S. E., has just returned from a three months' visit to the Hawaiian Islands.

Mr. Ashley was interested in every phase of the development of these islands and on his return presented an interesting lecture in his home, at Morgan Park. This lecture was illustrated with pictures taken by Mr. Ashley.

Mr. H. W. Malz, M. W. S. E., has opened an office at Room 231, Insurance Exchange, Chicago, as Industrial Engineer, specializing in factory layouts.

Mr. Malz was formerly connected with The Seng Company, as general engineer, and has had a wide experience in the design of manufacturing plants.

Mr. Allen F. Owen, M. W. S. E., formerly Chief Engineer for George C. Nimmons & Company, has opened an office in Room 1701 Marquette Building, Chicago, and will conduct business as Structural Engineer.

Mr. Edgar L. Drinkwater, M. W. S. E. has recently been appointed Mechanical Engineer, in charge of Engineering and Sales Work for Whitney & Ford, 4325 Cottage Grove Ave., Chicago, dealers in heating and plumbing supplies.

Peter Aagaard, M. W. S. E., has been elected President of the T. S. Leake Construction Company. Mr. Aagaard was born on September 9th, 1869, in Denmark. He was educated in the technical schools of Denmark, and later studied at Armour Institute, Chicago. Entering railway service in May, 1896, with the Illinois Central as a carpenter, his entire service up to the present has been with that company. In 1899, he became a general foreman and in 1905 was appointed supervisor. In 1912, he was promoted to superintendent of buildings, with headquarters at Chicago, the position he occupied at the time of his recent appointment.

Francis S. Peabody, Aff. W. S. E., has issued a pamphlet on "Americanization." He states the problem in the following terms:

> "AMERICANIZATION"—a problem of today greater than any our forefathers ever struggled with; a message that stirs the heart of every patriot; a slogan which in a few months, having lost concreteness of form, has been degraded to a mere catch word."

The work of the Salvation Army is favorably commented on by Mr. Peabody.

Mr. J. R. Cravath, M. W. S. E., announces his withdrawal from the firm of Fowle & Cravath. This is made necessary by Mr. Cravath's removal to the Pacific Coast.

His many friends in Chicago will wish Mr. Cravath all success. His active participation in the affairs of the Society have been very helpful in the past.

An Engineer in the Hall of Fame

Mr. James B. Eads, builder of the Eads Bridge, Mississippi Delta Jetties and other remarkable engineering enterprises, has been elected to the place among American "Immortals." Two hundred and four were nominated and seven elected to this high position.

WILLIAM D. PICKELS

William Dobson Pickels was born April 12th, 1839, at Addington, Yorkshire, England, and came to the United States, with his parents, at the age of seven years, locating at Wilmington, Delaware.

Early in 1898 he became associated with Warren Webster & Company, of Camden, N. J., who at the time were making ventilators, but later manufactured feed-water heaters and still later the Webster System of steam heating.

Mr. Pickels opened the Chicago office of Warren Webster & Company in 1890, and numbered among his life long acquaintances such men as Fred Sargent, Robert Quayle and General W. W. Atterbury.

Mr. Pickels died October 28th, 1920, at Mauch Chunk, Pa., and is survived by two daughters, Mrs. Ellen Butler, of Mauch Chunk, Pa., Mrs. Mary Altmeier, of Lansdowne, Pa., and his son, Howard Fielding, of Denver.

Mr. Pickels lived a most exemplary life and was beloved by all whom he came in contact. He inspired confidence wherever he went and many who learn the news of his passing away will recall with fond recollections their associations of this great and noble character.

Mr. Pickels contributed much to the Engineering profession. He became a member of the Western Society of Engineers, May 10th, 1895, and held his membership up to the time of his death.

National Research Council

The Fourth Annual Report of the National Research Council has been issued from the Government printing office.

This Council was established in 1916, at the request of the President of the United States, under the charter of the National Academy of Sciences. The broad general line of the permanent organization were determined shortly after the Armistice and the specific program was adopted on February 11th, 1919. The work of the past year has in a large measure been an effort to round out and complete the program and to put it into actual operation.

GIFTS TO THE COUNCIL

The Carnegie Corporation of New York has expressed its readiness to appropriate $5,000,000 to be placed at the disposal of the National Academy of Sciences for the purpose of the Academy and the National Research Council, provided that a suitable site be secured from other sources.

Through the generosity of Thomas D. Jones, Harold F. McCormick, Julius Rosenwald and Charles A. Swift, of Chicago, and other public spirited men of Cleveland, New York City, Rochester, Dayton, Detroit, Pittsburgh and Wilmington, the site has been secured in Washington, facing the Lincoln Memorial, in Potomac Park. The site cost about $200,000. Sketches are now being prepared for the building.

The Rockefeller Foundation has appropriated $500,000 to provide for Research Fellowships in Physics and Chemistry.

The officers of the Council are as follows:

George E. Hale, Honorary Chairman,
Director, Mount Wilson Observatory, Carnegie Institution of Washington, Pasadena, Cal.

Henry A. Bumstead, Chairman,
Professor of Physics, and Director of the Sloane Physical Laboratory, Yale University, New Haven, Conn.

Charles D. Walcott, First Vice-Chairman,
Secretary of the Smithsonian Institution, and President of the National Academy of Sciences, Washington, D. C.

Gano Dunn, Second Vice-Chairman,
President, J. G. White Engineering Corporation, 43 Exchange Place, New York, N. Y.

R. A. Millikan, Third Vice-Chairman,
Professor of Physics, University of Chicago, Chicago, Ill.
Vernon Kellogg, Permanent Secretary,
National Research Council, Washington, D. C.
F. L. Ransome, Treasurer,
Geologist, U. S. Geological Survey and Treasurer of the National Academy of Sciences, Washington, D .C.
Alfred D. Flinn, Assistant Secretary,
Secretary of the Engineering Foundation ,29 W. Thirty-ninth St., New York, N. Y.

Among the most recent work undertaken by the National Research Council is the Research Information Service as a general clearing-house and informational bureau for scientific and industrial research. This "Service" on request supplies information concerning research problems, progress, laboratories, equipment, methods, publications, personnel, funds, etc.

The Western Society of Engineers is co-operating with the National Research Council, Prof. A. N. Talbot representing the Society.

Acknowledgement

The Western Society of Engineers has recently received some very interesting framed photographs for use in the Society's rooms. These photographs show various phases of engineering achievement and are accepted with thanks.

Several others have been promised and are expected to arrive soon.

Those received are as follows:

Donor	Photograph
Amer. Locomotive Co.	2-19-2 Type Locomotive Rock Island Lines.
Frank D. Chase, Inc.	Plant of Saginaw Products Co., Division of General Motors Corporation.
General Electric Co.	Grand Central Terminal, New York, showing the terminal before and after electrification.
(South Shore Lines)	High Speed Electric Train.

Chicago, Lake Shore & South Bend Ry.

Sectional Book-Cases For Sale

The Library of the Western Society of Engineers has on hand sectional book-cases including tops and bases which are for sale.

These are on sale for from 50 to 75% of the present prices depending upon condition of the cases.

The present prices are as follows:

Sections 8″, 10″ and 12″.....	$7.50 each
Tops and bases.............	4.40 each

The book-cases are light oak finish manufactured by Globe-Wernicke Company.

These are offered to our members before offering them to others. Come in and make your selection.

Rental of Western Society of Engineers Auditorium

On account of the scarcity of meeting places in Chicago, the question is often asked, "Where will we meet?" This can be answered in many cases by communicating with the secretary for available dates.

Our Auditorium has a seating capacity of two hundred and is equipped with motion picture machine and projection lantern.

If you know of any society or club, or other organization wishing a central meeting place for morning, noon, afternoon, or evening sessions, kindly mention the Western Society of Engineers room.

Rates on application.

Year Book—Last Call—Registration Cards

Sometime ago, we sent to each member a registration card to be filled in and returned for use in compiling our Year Book. To date only 65% of these cards have been received back in the Secretary's office. In some cases since they were written our members have changed their connection, or address. It is very essential that our Year Book contain up-to-date information. Please do your part to make that possible.

Motion Pictures at Our Technical Meetings

The suggestion of the Development Committee that Motion Pictures be given at the opening of each of the Technical Meetings, has proved very satisfactory.

The Motion Pictures start promptly at 7 o'clock and those who are late have missed some very interesting pictures.

Among the films that have been shown are the following, which have been furnished by the General Electric Company:

"Panama Canal," "The King of the Rails," "The Electrical Giant," "Queen of the Waves," "The Sugar Trail," "Big Deeds."

Arrangements have been made for additional films at each of the Technical meetings.

Association of Chinese and American Engineers

Volume 1, Number 1, of Journal of the Association of Chinese and American Engineers, dated September, 1920, and published in Pekin, has been received. This Association was founded November 22nd, 1919, and has the sanction and approval of the Chinese Government.

It has for its object the "advancing of engineering knowledge and practice, the maintaining of high professional standards and fostering the spirit of cooperation and fellowship among engineers."

The Association has seven honorary members and one hundred members and associated members.

The Journal of the Society is a very commendable publication. In addition to technical papers, it contains important articles on engineering in China, personal notes and items of interest.

The Federated American Engineering Societies

The American Society of Civil Engineers, by letter ballot canvassed November 8th, voted to not join The Federated Engineering Society. There were approximately 5,600 votes cast out of a total corporate members of 8,700. The majority cast against joining the Federation was 948.

While other National Societies have decided to join the Federation, the action has been taken by the National Board and not by the vote of the members. It would be interesting to know if the membership of other societies would vote as the membership of the American Society of Engineers has voted.

National Rivers and Harbors Congress

The Sixteenth Annual Convention of the National Rivers and Harbors Congress, will be held in Washington on the 8th, 9th and 10th of December.

Sessions will be held at the New Willard Hotel.

Waterways as an important factor in transportation will be the general subject of discussion.

American Society of Agricultural Engineers

J. R. Howard, president of the American Farm Bureau Federation, will address the annual meeting of the American Society of Agricultural Engineers to be held December 28th, 29th and 30th, at the Hotel Sherman, Chicago. His subject will be "The Importance of Machinery as Related to Agriculture." The activity and influence of the Farm Bureau Federation will lend much interest to Mr. Howard's discussion.

K. J. T. Eblaw, engineering editor of the National Farm Power Publications, will discuss "The Artificial Heating of Animal Shelters," a subject to which he has been devoting special study and in which it is understood some interesting development has been made.

E. V. Collins, assistant chief in Agricultural Engineering of the Iowa Experiment Station, will present a paper on "Some Factors Influencing the Draft of Plows." A great deal of the discussion and investigation of the past year pertaining to the draft of plows and plowing speeds has been based on work done at the Iowa Station.

Forty-first Annual Meeting—American Society of Mechanical Engineers

Engineering Societies Building, 29 W. 39th Street, New York City, December 7th-10th, 1920.

"Transportation is to be the keynote of this meeting."

There has been invited the foremost authorities in the various fields of transportation, to present practical measures for improving the conditions, which are now recognized as being inadequate.

Among the speakers on this occasion is Mr. Chas. A. Morse, M. W. S. E., Chief Engineer, Chicago, Rock Island & Pacific Railway Company.

There will be meetings of the several professional sections of the Society as represented by the Fuel Section, Forest Products, Machine Shop Management, Railroad, Design, Textal, and Power Sections.

On Wednesday evening the Brashear Memorial will be held. Dr. Henry Prichett, President of the Carnegie Foundation, for the Advancement of Teaching, will deliver the address.

Revised Requirements for Structural Engineers—State of Illinois

The Department of Registration and Education has recently modified the requirements for registration of structural engineers. The applicant may furnish blue-print or other reproductions of design and specifications of important work prepared by himself, with affidavits or other supporting evidence testifying to the degree of his actual relationship thereto and the responsibility for same, which will be considered as an essential point of his examination.

A circular of instructions issued in accordance with this revised requirements, includes the following:

> "If an applicant is prepared to furnish blueprints or other reproductions of design and specifications of important pieces of work prepared by him as per paragraph 4 of "Instructions to Applicants" in his formal application, they should be sent to the Chicago office of the Department of Registration and Education, 130. N. Wells Street, Room 1201, at least 15 days before the examination. They should NOT be sent to Springfield. All such applicants will be required to appear in person before the Professional Committee of Examiners connected with the Department of Registration and Education on the first day of the examination, at which time each will be given an examination on these blue prints and other reproductions, which may be entirely oral, or partly oral and partly written.
>
> If as a result of this examination, together with a detailed investigation of his professional record, as submitted in his application, the committee determines to its satisfaction that the applicant is entitled to a certificate of registration, he will be so notified and will not be required to take any further examination.

The revised requirements are the result of the recommendations of the Professional Committee for structural engineers, consisting of Mr. Andrews Allen, Chairman; I. F. Stern, Secretary; T. L. Condron, F. H. Newell and F. C. H. Arentz.

Council of State Boards of Engineering Examiners

This Council was organized at a meeting held in Chicago on November 8th and 9th. The meeting was attended by fifteen members of the Boards of Engineering Examiners, representing the States of Colorado, Michigan, Iowa, Florida, South Dakota, Louisiana and Illinois.

At this meeting permanent organization was established with the following officers:

President, M. Gasaud, New Orleans; Vice President, C. S. Hammett, Jacksonville, Fla.; Secretary, Alvin LeVan, Des Moines, Iowa.

There was found to be many important matters for discussion at this meeting. The net result was the adoption as the object of the Society to secure uniformity of practice in examinations and requirements for examination and to establish reciprocity between the several states.

The following resolution was adopted:

> Resolved: That it is the sense of this Council that the submission of the evidence of qualifications of the applicant for the practice of professional engineering should be considered as the essential part of the examination and that reciprocal registration certificate should be granted to an applicant who has submitted such satisfactory evidence to the Examining Board of his own state.

It was the unanimous opinion of those present at this meeting that reciprocity should be established. This will enable the registered engineer of one state who has passed the engineering examination to be registered in all states having similar registration laws.

In the State of Illinois and in some other states, a certificate of registration was issued to practicing structural engineers, without examination.

In order to avail themselves of the reciprocity outlined above, it is apparent that some form of examination should be undertaken.

Building Conditions in Chicago

Construction in Chicago, has been at a standstill for some months. At the present time there is a large amount of unemployment among the skilled trades.

In an effort to stimulate building conditions, the Building Trades Council, representing the crafts have assured the real estate interests and the Building Construction Employers' Association that there will be no demand for an increase of wages at the expiration of the present contracts, and furthermore that because of the operation of the National Board for jurisdictional award, there will be no jurisdictional strikes.

It is not clearly known whether the Building Trades Council will be willing to refer for adjustment such matters as affect open shop and the use of materials furnished by open shop industries, without calling strikes. There will be, however, a consistent effort to come to understandings which will make it possible to undertake building construction in Chicago. The action outlined above does not indicate any reduction in the price of labor. It will greatly assist if wages can be stabilized.

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NEW MEMBERS

At the meeting of the Board of Direction, held October 25, 1920, the following new members were elected:

125-20	Bernd, Joseph C., 700 S. Morgan St., Chicago	Associate
132-20	Hettelsater, D. R., 706 Mutual Bldg., Kansas City, Mo.	Member
133-20	Mellish, Joseph L., 211 Laramie Ave., Chicago	Associate
134-20	Michels, Thomas, 6426 Union Ave., Chicago	Student
136-20	Richards, Geo. James, 2820 Sigsbee St., Erie, Pa.	Associate
1678-19	Henning, W. K., 808 S. Harvey Ave., Oak Park, Ill.	Member
127-20	O'Donnell, P. F., 12 S. Clinton St., Chicago	Affiliated
17-20	Hershey, Harry E., 1001 Van Buren St., Chicago	Member
37-20	Maher, E. E., 30 N. Michigan Ave., Chicago	Member
123-20	Olsen, Paul F., 127 N. Dearborn St., Chicago	Member
128-20	Piersol, J. A., 6059 Harper Ave., Chicago	Associate
130-20	Pick, Chas. W., 3843 Monticello Ave., Chicago	Associate
131-20	Armstrong, Herbert J., Care Armour Inst. of Tech., 3301 Federal St., Chicago	Member
138-20	McClary, Geo. B., 343 S. Dearborn St., Chicago	Associate
139-20	Smith, Henry W., P. O. Box 896, Huron, S. Dak.	Associate
854-19	Currier, Hiram D., Care Kellogg Switch & Sup., Adams and Aberdeen Sts., Chicago	Member
1162-19	Loyth, Jas. G., 3138 Fullerton Ave., Chicago	Associate
1222-19	Salschenberger, F. S., 217 N. Jefferson St., Chicago	Associate
1719-19	Brown, John E. H., Care Dearborn Chemical Co., 1029 W. 35th St., Chicago	Associate
1783-19	Pereiva, John DeMacelo, Care Bellefontaine Bridge & Steel Co., Bellefontaine, Ohio	Associate
1860-19	Ray, Arthur J., 409 N. 7th Ave., Maywood, Ill.,	Member

APPLICATIONS RECEIVED

Applications for membership received since the meeting of the Board of Direction, held October 18, 1920:

140	Nathan Lesser	Chicago, Ill.
141	Rudolph C. Johnson	Chicago, Ill.
142	Grant Allyn Caproni	Salt Lake City, Utah
143	Geo. Braun, Jr.	Chicago, Ill.
144	William James Stehlik	Alonquin, Ill.
145	Frederick Arthur Pement	Chicago, Ill.
146	H. O. Hauge	Chicago, Ill.
147	D. Royce Hyde	Chicago, Ill.
148	Benjamin F. Morison	Chicago, Ill.
149	Richard F. B. Campbell	Chicago, Ill.
150	George N. Simpson	Chicago, Ill.
151	James H. Watt	Chicago, Ill.
152	Sam L. Kelisky	Milwaukee, Wis.
153	Frank H. Bernhard	Chicago, Ill.
154	Joseph Loyd Tallman	Sioux City, Iowa
155	Robert E. Kinkead	Chicago, Ill.
156	Arthur R. Eitzen	Chicago, Ill.
157	Chas. S. Duke	Chicago, Ill.

Members are requested to communicate with Secretary with regard to qualifications of the above applicants for membership in the Society.

EDGAR S. NETHERCUT, Secretary.

ADDRESSES WANTED

In order to have our records of members addresses complete, we ask that anyone knowing the present address of members listed below to communicate with the Secretary.

Name	Last Address Given
James L. Anning	Care Rice Hotel, Houston, Texas
E. R. Swanson	1705 Harris Trust Bldg., Chicago
Chas. Edward Drobnyk	1934 Washington Blvd., Chicago
H. I. Eagen	Room 1101, 189 W. Madison St., Chicago
Floyd E. Evans	5252 Calumet Ave., Chicago
L. B. Fugitt	302 Piedmont Bldg., Charlotte, N. C.
John J. Gibbins	1412 North Ave., Milwaukee, Wis.
Earl Hilton	5237 Ingleside Ave., Chicago
Fred A. Locke	2017 Maple Ave., Evanston, Ill.
George O. Neumann	3127 Clybourn Ave., Chicago
J. T. Powers	2843 N. Talman Ave., Chicago
Harry M. Trippe	Maj. Eng. 308th Reg., Camp Sherman, Ohio
Albert S. Shiavitz	Care H. Muller Mfg. Co., Ltd., Sarnia, Ont., Canada
H. B. Williams	812½ Mary St., Flint, Mich.

EMPLOYMENT SERVICE

Do you need assistants?

Do you want a position?

Do you feel that you have men in your employ that are needed more in some other position?

Do you wish a change or advancement? The service we render is to bring men together for their mutual benefit. In order to do this, we offer free of charge, this Employment Service. Will you use it?

Positions Wanted

B-723: ENGINEER ON HARBOR STRUCTURES, foundations, steel and concrete structures of all kinds, familiar with design and details of construction of buildings and other structures wants position as designing engineer, squad boss, chief draftsman, estimator or supervising engr., preferably in contractor's office.

B-751: MECH. ENG., 12 YEARS' EXPERIENCE with public utility company, broad business training as assistant to chief executive, married, wishes to get into a field where salary is proportional to responsibility.

B-763: MECHANICAL AND STRUCTURAL draftsman well qualified to make drawings for catalogues desires part time work.

B-770: GRADUATE M. E. HAVING MADE special study Gas and Gasoline Engines desires position in construction or sales engineering work.

B-771: CAPABLE M. E. WITH 12 YEARS broad experience who knows his business and gets results is open for position, supervisor of design, construction, or maintenance and improvement of power or industrial plant.

B-772: ENGINEER WITH EXPERIENCE IN patent investigation and research work on internal combustion engines, motor trucks and tractors wants to locate with small manufacturing concern where experience could be used to advantage.

B-773: HIGH CLASS SUPERINTENDENT machine shop, construction or erecting foreman and maintenance engineer, 14 years in responsible positions is open for engagement along above lines.

B-774: MECHANICAL AND ARCHITECTURAL Draftsman ,at present employed, open to position where opportunities for advancement are afforded.

B-775: GRADUATE ELECTRICAL ENGINEER, 1914, with 3 years' experience under prominent consulting engineers wants position in electrical engineering field.

B-776: CIVIL ENGINEER HAVING HAD valuation experience, drafting and instrument work on railroad, also familiar mechanical drafting and concrete work in railroad construction, speaks Spanish fluently, open to engagement, U. S. or foreign service.

B-777: POSITION WANTED AS MAINTENANCE or plant engineer, mechanical engineer or assistant superintendent.

B-778: ENGINEER DRAFTSMAN, FIELD Draftsman or Instrument Man desires position in above fields with opportunities for advancement.

B-779: CAPABLE ELECTRICAL ENGINEER with experience in general engineering practice desires position as electrical or construction engineer, consulting engineer or industrial plant engineer.

B-780: CONCRETE DESIGNER WITH EXPERIENCE in industrial fields, having had charge of concrete buildings, open for position as concrete engineer.

B-781: INSTRUMENT MAN AND DRAFTSMAN, 5 years' experience C. E., railway maintenance, concrete work, track elevation and bridge experience with prominent Western R. R.

B-782: DRAFTSMAN—CONCRETE, EXPERIENCE in field work for five years, some supervision on concrete form work wishes work along above lines.

B-783: ENGINEER THOROUGHLY EXPERIENCED in all branches of general building construction and plant maintenance open for position as plant maintenance engineer, cost engineer, superintendent, district manager of efficiency engineer.

B-784: AVAILABLE, ENGINEER WITH wide experience railway construction, location, plants, roads, appraisal and general practice, executive or sales engineer would be considered.

B-785: STRUCTURAL ENGINEER, EXPERIENCED on coal tipples, bridges and coal handling machinery seeks work along above lines.

B-786: BUILDING SUPERINTENDENT, either with architect or contractor, 9 years' experience, available for work as above indicated.

Positions Wanted—Continued

B-787: POSITION WANTED AS DESIGNER or engineer on power, chemical and industrial plants, 8 years' experience in general engineering, including installation, maintenance and design.

B-788: MECHANICAL ENGINEER SPECIALizing in internal combustion engines, has had experimental research and development work in carburetion.

B-789: ENGINEER DESIRES POSITION IN manufacturing plant, preferably in production work or maintenance department, also qualified as safety engineer.

B-780: ELECTRICAL ENGINEER I SOPEN for position in electric railway or power work, engineering sales or construction and operation.

Positions Wanted—Continued

B-791: ENGINEER WISHES TO LOCATE AS M. E., power plant, designing engineer or estimating steam or electroicity, 17 years' experience.

B-792: GRADUATE C. E., PURDUE 1916, seeks location in Chicago as contract agent, now employed as power salesman and contract agent, age 29, married.

B-793: C. E. GRADUATE, 20 YEARS' EXperience, estimates, design and construction of bridges, subways and coaling stations in structural steel or reinforced concrete open for engagement.

WESTERN SOCIETY OF ENGINEERS FOUNDED 1869

Have you wondered what to buy yourself for Christmas? If so, nothing would be more appropriate for an engineer than a Society Badge or a Certificate of Membership. We are prepared to supply both promptly.

Gold Badge with Blue Enamel, for Members and Associate Members.......	$3.00
Silver Badge with Green Enamel, for Affiliated and Junior Members.......	$2.00
Certificates, Engrossed with Seal of the Society, ready for framing.......	$1.00

Date..................................

To the Secretary,
Western Society of Engineers
Room 1736—53 W. Jackson Blvd.,
Chicago, Ill.

Please send me: Gold Badge
Silver Badge
Certificate of Membership

for which I enclose the sum of.....................

Name.......................................

Address....................................

TECHNICAL SECTION

JOURNAL OF THE

WESTERN SOCIETY *of* ENGINEERS

Volume XXV DECEMBER, 1920 Number 16

The Transition From Manual to Automatic Switching of Telephone Traffic in Large Metropolitan Networks

FRED L. BAER,* M. W. S. E.

Presented May 24, 1920.

In presenting this paper to you, I trust that those who may have seen the announcements, will not be disappointed when they find that the subject treated is rather an old one, having had its inception nearly thirty years ago. While it is true it has been of commercial importance perhaps only since the beginning of this wonderful twentieth century, it has come to be considered a necessity only within the last few years. Automatic central office equipment as installed in 1905 and still in service is shown in Figure A. A more recent illustration is shown in Figure B.

The equipment contemplated in this paper is of the well known Strowger type. This equipment works on the step by step principal, directly responsive to the calling device (dial) at the subscriber's station. A wall type telephone with calling device is shown in figure 1. A Strowger type selector and connector are shown in figures 2 and 3. Note particularly the movable element, called the shaft, with its wipers. Let us consider for a moment the action of setting up a connection in a four digit system. If the number wanted is, say, 2476, lift the receiver from the hook, and insert the finger in the hole in the dial over the figure "2," pull the dial until the finger strikes the "finger stop," then allow the dial to return to its normal position of its own accord, after which the figures "4," "7," "6," are pulled in sequence. After the last figure, "6" in this case, has been pulled, the calling line is in connection with the called line and the bell of the called line will be rung, provided the line is "free." If the line is busy, an audible busy signal will be given to the calling party, in which case the receiver should be hung up and another attempt made later. While the dial is returning to its normal position after the first pull

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*Sales Engineer, Automatic Electric Co.

"2," there are two interruptions of the circuit. These interruptions cause the line relays and step up magnets of the first selector in the central office to function, lifting the shaft to the second level, after which the wipers pass over the contacts of the bank level, searching the field and seizing the first non-busy trunk, which extends the line to the next switch in the train, called the second selector, which acts similarly on the fourth level in extending the line to a connector in the 2400 group. The third digit, "7," steps the connector shaft and wiper up to the seventh level, and the fourth digit, "6," steps it around to the sixth contact, thus connecting with terminal 76 in the 2400 group, or "2476." The connector switch performs the functions of an operator and a cord circuit in manual practice, that is, it picks out the called line, tests it for busy, gives the busy signal if the line is busy, or seizes the line and rings, if it is not busy, and disconnects when the conversation has been completed. The selector switches are merely electro mechanical means for extending the calling line to the connector.

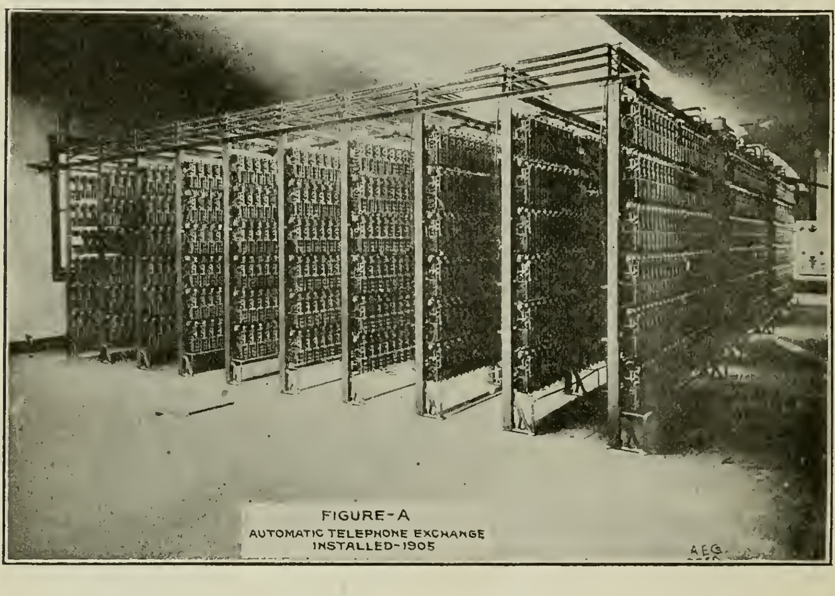
FIGURE-A
AUTOMATIC TELEPHONE EXCHANGE
INSTALLED-1905

Instead of having a first selector associated with each subscriber's line, as was done in the early days, it is found more economical to introduce a primary line switch for each subscriber's line, and perhaps, also, secondary line switches, and then reducing the number of first selectors to take care of the probable maximum simultaneous demand. The function of the line switch in this case, is to extend the calling line to one of a reduced number of selectors.

Figures 4 and 5 show "Keith" or plunger type primary and secondary line switches. Figure 6 shows a rotary type line switch which may be used as a primary line switch or as a secondary line switch in conjunction with plunger type or rotary type primaries.

The title of this paper might suggest that the writer will describe some ready made plan to solve the many problems that arise in the conversion of a large network to an automatic basis, but realizing that these problems involve intricate questions of plant, traffic and commercial engineering, nothing further has been attempted in the limited time available to prepare this paper than to set forth some of the general principles governing the use of automatic switching equipment.

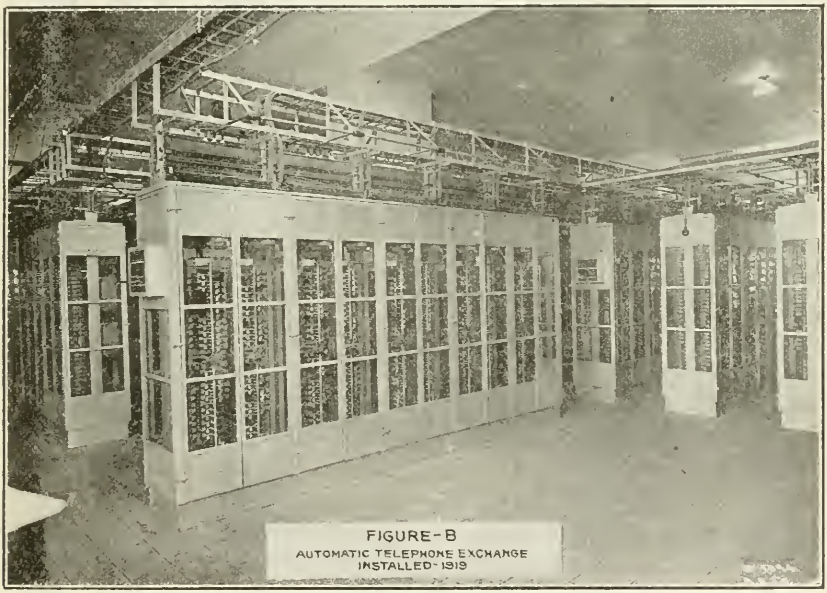

FIGURE-B
AUTOMATIC TELEPHONE EXCHANGE
INSTALLED-1919

Some of the factors that have been instrumental in forcing the era of automatics are the time proven advantages of full automatic operation from a service and cost standpoint. These are mentioned only in passing, under the headings of Accuracy, Speed, Uniformity, Flexibility, Dependability, Operating, Maintenance and Fixed Charges.

Accuracy—Under average automatic operating conditions the errors due to the automatic equipment are so low as to be almost negligible, while under manual conditions, especially as at present existing, the errors are very pronounced.

Speed—The facility with which calls can be set up by means of the dial and the equal facility with which they can be disconnected by means of the hook switch are recognized not only by operating companies but by subscribers also. Indeed, they are the two foremost advantages mentioned by the majority of subscribers in any automatic system.

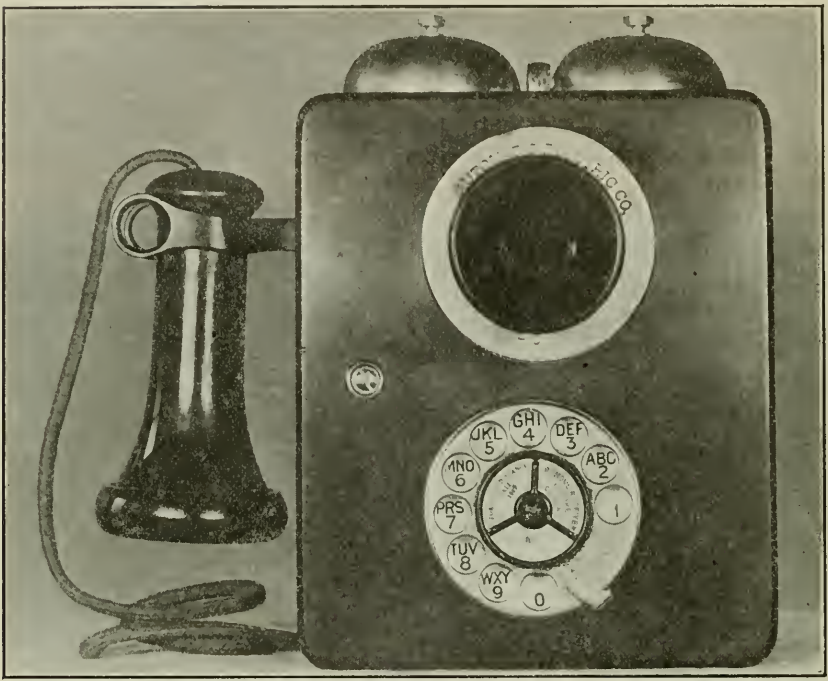

FIG. 1
WALL TYPE TELEPHONE

Uniformity—The advantages above mentioned are the same at any time of the day or any season of the year, and, within the limits of the trunking provided, the advantages are present during emergencies when originally the human element fails.

Flexibility—The automatic has shown itself adaptable not only in meeting the ordinary operating requirements, but also in the special requirements imposed by long distance, toll, rural and private exchange service.

Dependability—Considering the repeated reports of how operating companies using automatic equipment weather the difficulties of prolonged strikes during which time the automatic equipment receives little or no maintenance, it is not necessary to make any further explanation.

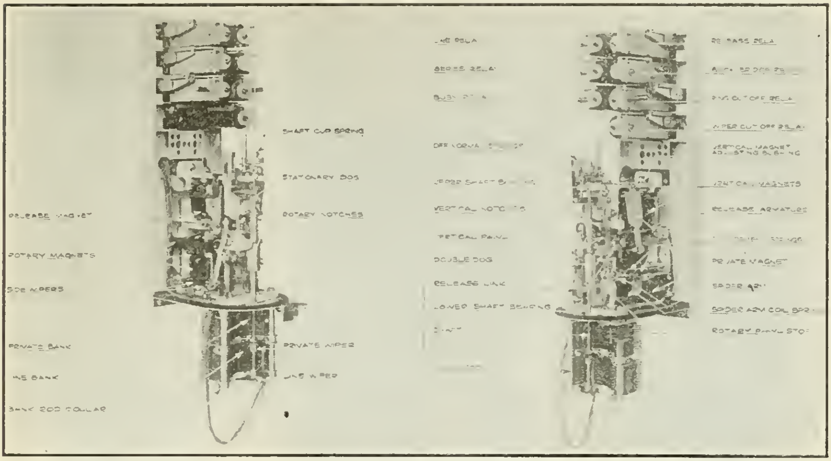

FIG. 2—SELECTOR

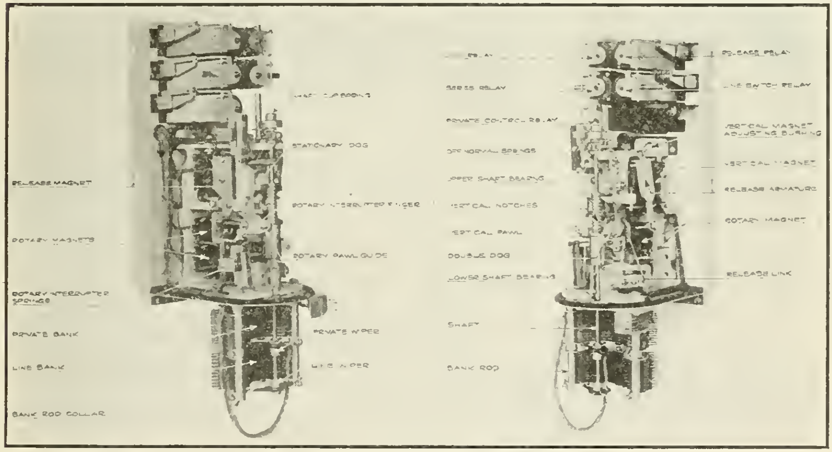

FIG. 3—CONNECTOR

Operating—The automatic avoids the necessity of offering bonuses or paying housing expenses for a large staff, whereas, in a manual system, even with such concessions, the turn-over of the operating force is so great that it is impossible to average more than a very mediocre force.

Maintenance—Experience under practically all conditions has shown that the maintenance of automatic equipment rarely requires more help than was necessary for the manual equipment which it replaced, and in some cases, even less help is required.

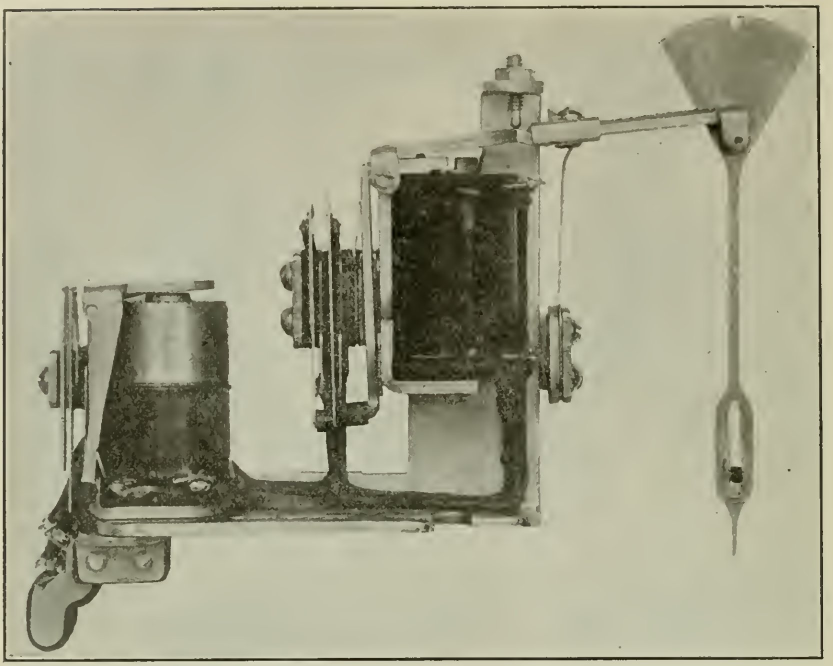

FIG. 4 KEITH PRIMARY LINE SWITCH

Fixed Charges—Due, of course, to the somewhat higher first cost of automatic, the interest charge will be greater, but to offset this, there is the lower rate of depreciation, dut to the recognized and demonstrated longer life of the automatic equipment. Time was when the automatic sales engineer, to prove in automatic equipment, had to consider the remaining value of the manual equipment, but now that the superiority of automatic equipment is generally recognized and a critical public will soon demand it, the burden is on the operating companies to set up greater reserves to provide for the rapid obsolescence of the manual system.

General—

It is no longer necessary to prove that the public will accept the so-called burden of dialing, because, as a matter of fact, the average telephone user is pleased to have within his own control the means for establishing connections. The people who fancy they are too busy to do their own calling, of course, base their preference on their unpleasant experiences with the human element, and where these particular people have been properly instructed in the use of the dial, they soon find that it greatly conserves their time, and they become enthusiastic in its use.

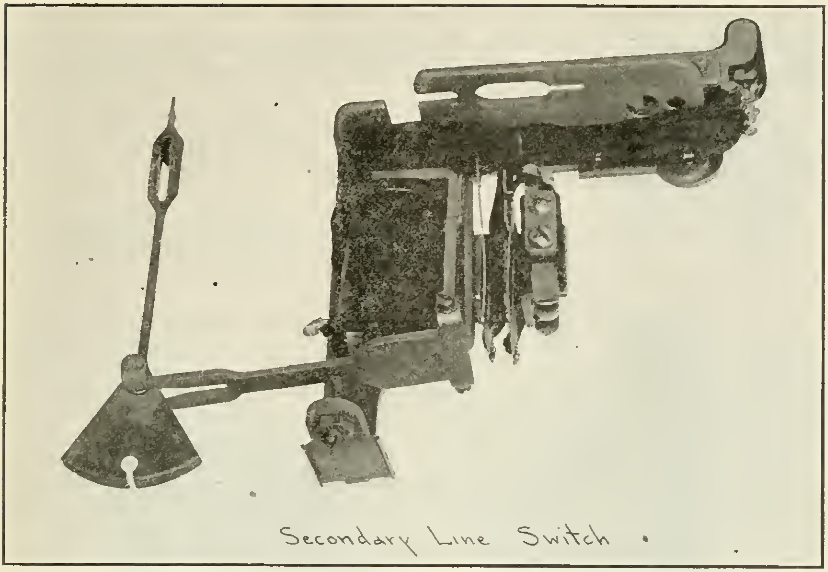

FIG. 5
KEITH SECONDARY LINE SWITCH

It is no longer necessary to prove that the dial is not an added source of expense to the sub-station because costs obtained from operating exchanges in all parts of the world show that the cost of labor and material per dial in service is only a matter of a few cents per dial per year, and the total cost of sub-station maintenance is less than under manual condition. This, to some extent, is accounted for by the greater efficiency of the repair men resulting from the ease with which they can make their tests.

THE TRANSITION FROM MANUAL TO AUTOMATIC SWITCHING

The transition from manual to automatic switching in a single office area is usually a simple matter of installing the requisite automatic equipment, either in the same building housing the existing manual equipment, or in a new building, and then after the sub-station equipment has been installed and all equipment has been thoroughly tested, to simultaneously cut the new equipment into service and discontinue the old. However, the other extreme of a large metropolitan area, consisting of many offices, presents many problems in the solution of which, fortunately, we can be guided by the experience of the past in which many of the problems were individually encountered.

In the case of a network with several hundred thousand subscribers in, say, thirty or more offices, it becomes almost obvious that the change should be made in one or two offices at a time, and that it would not be practicable to convert the entire network at once, due more to economic than to physical limitations. This, then, necessarily introduces a period of mixed operation during which there are calls from manual to manual, from automatic to automatic, from manual to automatic, and from automatic to manual. While several methods may be available for handling each of the various kinds of service, there is usually some one plan which is most applicable to meet the exigencies of a particular case.

I shall briefly describe the various methods for handling the different classes of calls as follows:

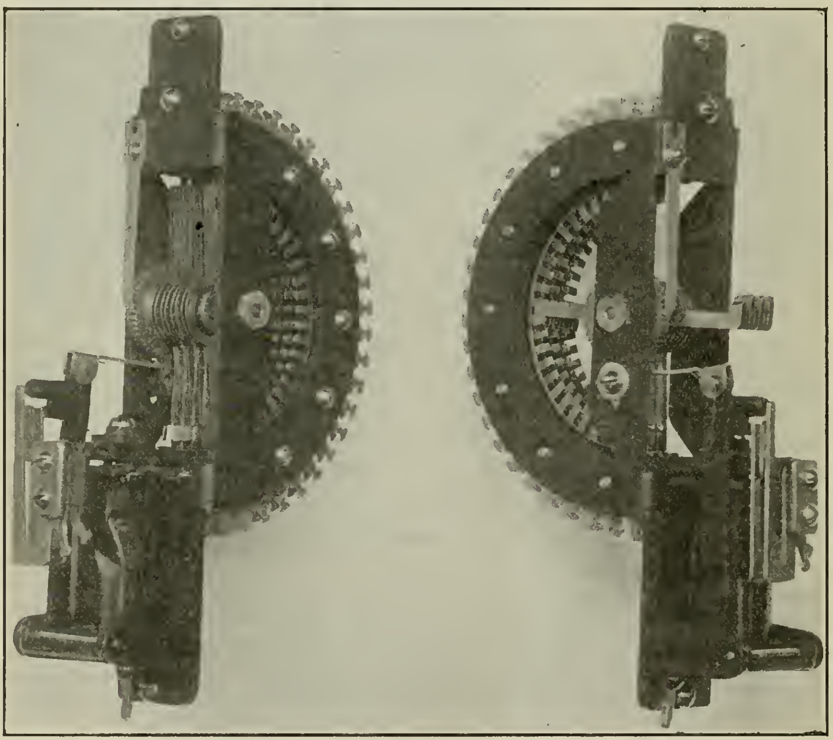

FIG 6
ROTARY TYPE SWITCH

Manual to Manual: As is generally known, in modern common battery practice, the subscriber lifts his receiver and signals an operator, known as the subscribers' or "A" operator, who has means for completing calls locally in the multiple, or by order wire and outgoing trunks to a "B" operator in a distant office. The subscriber's bell is rung, either manually, or by means of a key, or mechanically by means of a suitably interrupted ringing current from a ringing machine.

The "A" operator has control of the connection and when both subscribers have hung up, the "A" operator receives double supervision and takes down the connection, which in turn gives the "B" operator disconnect supervision. The "B" operator then takes down the connection, restoring conditions to normal.

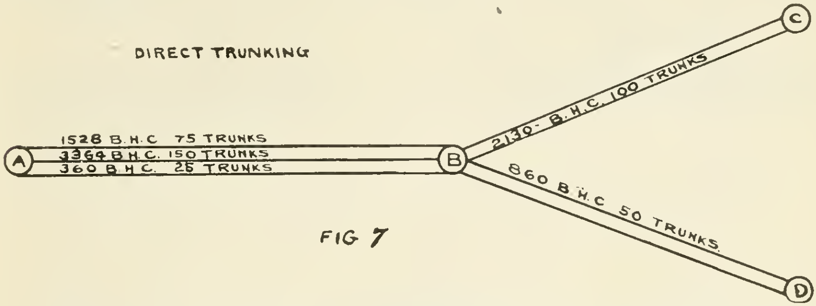

FIG 7

Automatic to Automatic: Assuming a six digit system having a theoretical capacity of one million numbers, the subscriber lifts his receiver and dials one digit after another, and, when the last digit has been dialed, the calling line is in connection with the called line, if it is available. The subscriber's bell is rung intermittently by means of interrupted ringing current from a suitable ringing machine. When the calling party hangs up, the connection is released, except the final switch, which is not released until the called party hangs up. In case the called line is busy, the calling subscriber would, of course, obtain an audible busy signal indicating the fact, and it would then be necessary to hang up and repeat the call after a reasonable time.

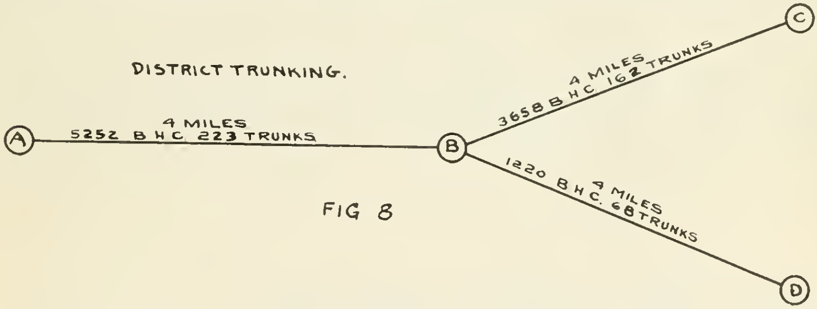

FIG 8

Ordinarily, an automatic office or unit in a network would have a capacity of ten thousand numbers, as is usual in manual offices under similar conditions. The first two digits would be required to reach the terminating office, either direct, or through a switching office, the remaining digits would call the thousand, hundred, ten and unit in the office of the subscriber wanted.

Manual to Automatic: It is obvious that the "A" operator in a manual office must have means of disposing of any calls that originate before her, regardless of what its destination may be. Four plans are available for providing means for completion of calls to the automatic offices, as follows:

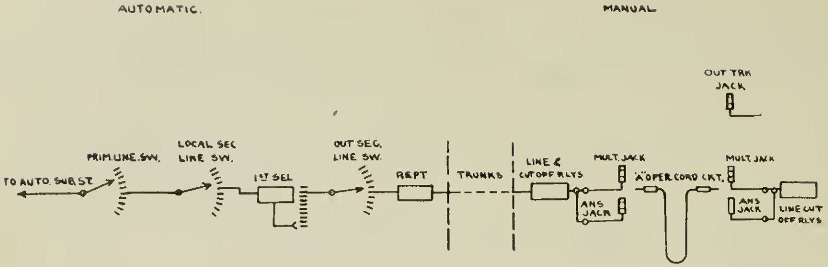

FIGURE - 9
AUTOMATIC TO MANUAL

First: All "A" operators' positions can be equipped with dials, and arranged so that, by means of a dial cut in key and suitable trunks to the automatic offices, the operator can dial the last four digits of the number wanted. Standard supervision would be obtained, and the control of the connection would remain with the "A" operator. The amount of work involved in handling a four digit call in this manner is practically the same as in handling a manual trunk call, so that if the percentage of trunking does not change, an "A" operator should handle practically the same number of calls as previously. If, in order to economize on trunks, it is found advisable that the operator dial five or six digits, the work will be slightly increased, to the extent of about .078 of a unit call per additional digit. Considering the standard operator's load as 240 unit calls and evaluating the calls as follows:

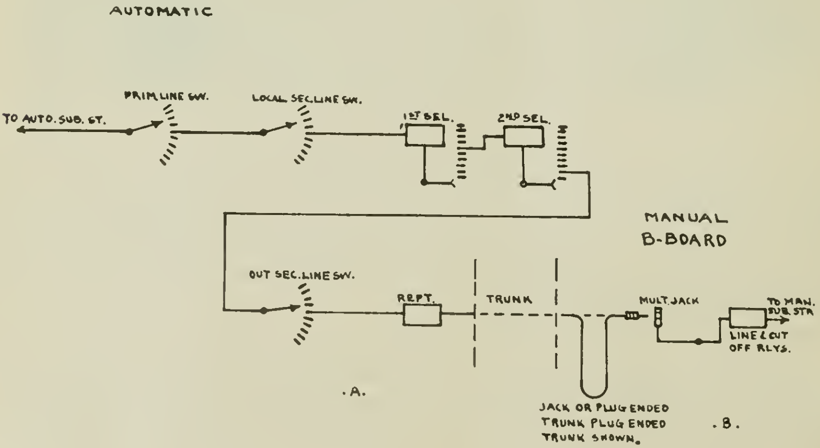

FIGURE 10

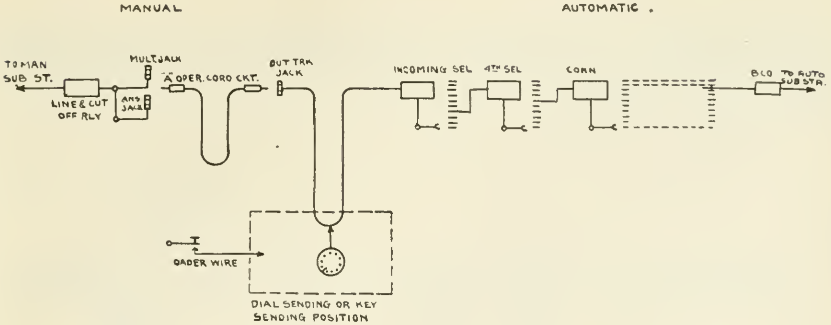

FIGURE-11
MANUAL TO AUTOMATIC

Local call	1
Manual trunk call (order wire)	1.5
Automatic trunk call (4 digit)	1.65
Automatic trunk call (6 digit)	1.81

and assuming that the trunking to other offices is 60%, then an operator could handle 75 local calls and 110 manual trunked calls. To handle this number of calls, if the trunk calls are dialed by 4 digits, would require 1.069 "A" operators, and to handle the same number of calls if the trunk calls are dialed by 6 digits, would require 1.14 "A" operators. We case that in the case of dialing the four digit calls, about 7% more "A" operators are required, while for the six digit calls about 14% more "A" operators are required.

It is recognized that the "A" operators' load during the busy hours, where there is a fairly large percentage of trunking, is determined by the possible congestion on the order wires, a circumstances entirely beyond the control of the "A" operator; while if the "A"

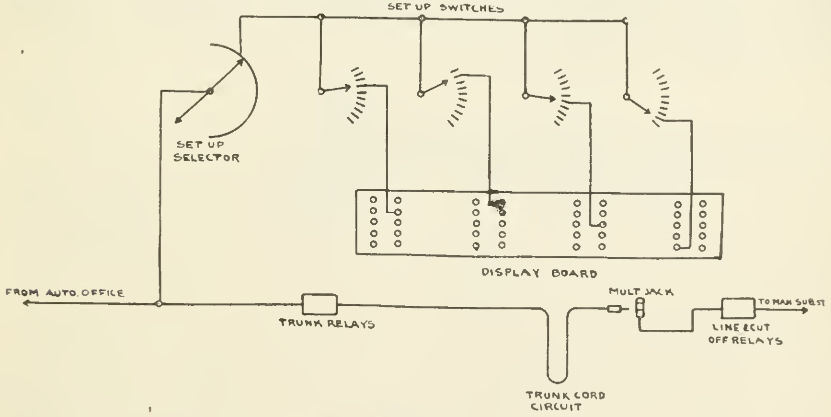

FIGURE-12
AUTOMATIC TO MANUAL CALL INDICATOR

operator can dial the trunk calls, everything is under her own control. It is quite evident, therefore, that the slight additional operating burden on the "A" operators would not be the determining factor in deciding the plan for handling these calls.

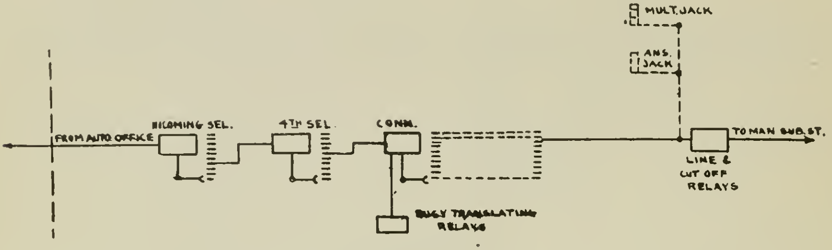

FIGURE-13
AUTOMATIC TO MANUAL FINAL SWITCHES

The cost of equipping the positions with dial and the outgoing trunk jacks with control relays is relatively small. An important consideration is the question of properly training the operating staff in the correct and accurate use of the dial. In a network where perhaps only one or two offices are automatic and perhaps thirty or more are manual, such instruction of the entire manual staff would be quite a task. Undoubtedly, there is a time in the transition period when it would be advantageous to equip the remaining manual offices with position dials and allow the "A" operators to complete their own automatic trunk calls. Another question that must be given consideration in the early stages of the transition period, which, however, is more a matter of psychology than engineering, is the effect on the morale of the staff. Difficulty from this source can be avoided by a considerate and well-defined policy.

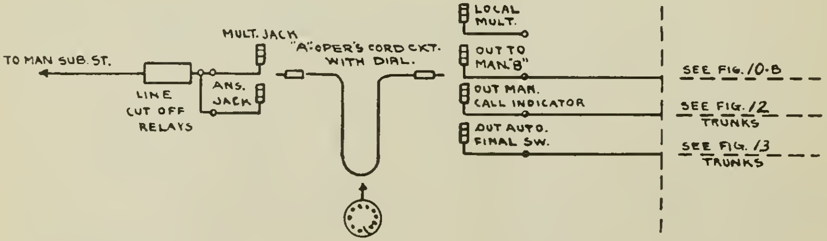

FIGURE-14

Second: The "A" operator can extend the call over a trunk to a special dialing operator after having obtained a trunk assignment by order wire. The "A" operator's work on such a call would be identical with that involved in a manual trunk connection. The supervision and control of the connection would remain with the "A" operator. The dialing operator's desk would have only a position dial and a cut-in key for each trunk looped through the position. A dialing operator, thus equipped, could handle from 300 to 350 four digit calls, or from 250 to 280 six digit calls. Desks for this purpose are rather inexpensive, especially if they can be located in the originating manual office, thus permitting the use of a three-wire circuit within the office.

Third: This differs from the preceding only in that the sending operator's position is equipped with a push buttons type impulse sending machine instead of a dial. The equipment involved in such a switchboard is considerably more expensive than that in a dial position. An operator at one of these positions will handle from 550 to 600 four digit calls during the busy hour and from 475 to 525 six digit calls.

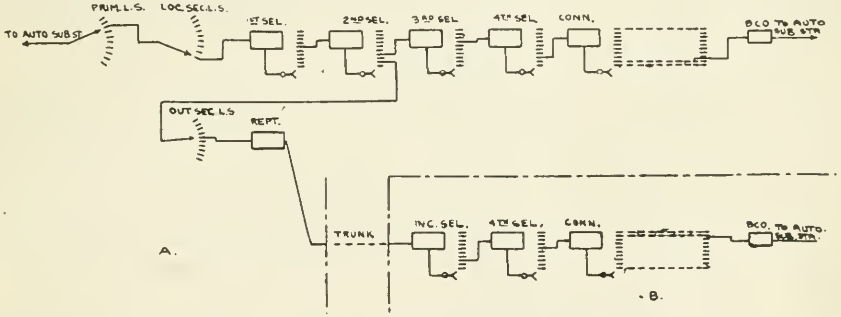

FIGURE 15 AUTOMATIC TO AUTOMATIC

If this method of sending is used, the positions should be centered at one or more district points, where the combined traffic of several automatic offices can be handled.

Fourth: The "A" operator can extend the call over a trunk to a "B" operator after having obtained an assignment by order wire, the same as in manual practice. The "B" operator's position would be equipped with a multiple of the automatic terminals. If these positions be arranged for keyless ringing, an operator could handle from 400 to 450 calls during the busy hour. It must be kept in mind that the guarding potential on automatic lines is positive, and on manual lines it is ordinarily negative so that the "B" positions would have to be changed accordingly. It is quite likely that, unless the automatic equipment is housed in the same building in which the displaced manual equipment is located, and further that the manual main and intermediate ristributing frames are to be retained, and still further, that there is available spare "B" equipment that can be prepared for this new service, and that this equipment can remain indefinitely in its present location, it would not be economical to install a "B" board with a full multiple, just for this purpose.

From the preceding, it appears that the increased work, if the "A" operator does the dialing, is so slight that it need hardly be considered, but that any of the other methods do involve an additional operating expense for the dialing, sending or "B" operator. If considerations of staff training preclude the use of the first method, any of the other methods may be adopted, for considerations of the relative annual charges.

Automatic to Manual: Several plans are possible for providing for traffic from automatic to manual, as follows:

First: A separate call number to reach the manual operator. In this case the directory listings would have to differentiate between subscribers' numbers connected to the automatic and those connected to the manual system, and the calling subscriber would have to be instructed that, for connection to manual numbers, a predetermined digit, say "9," would have to be called.

The call would be routed to the nearest manual office, where it could terminate on a regular manual line circuit, and the "A" operator would answer and handle the call the same as a regular manual call. This plan is not feasible when any of the automatic lines are subject to service discrimination or if there is any message rate service. If the "A" cord circuits are arranged for flashing recall, then no provision need be made to guard the trunk when the automatic party hangs up before the operator disconnects.

Second: Separate call numbers to reach the manual operator in the proper office. In this case also, the directory listings would have to differentiate between the two classes of numbers, and in addition the subscriber would be instructed to call certain digits for particular offices. The call would be routed to the proper manual office, where it would terminate before a "B" operator. The circuits can be arranged for message rate service, if required. If the trunks are plug ended, and arranged for machine ringing, an operator can handle about 300 busy hour calls.

Third: Number indicated on a visual indicator before an operator. In this case all directory listings would be on the full automatic basis, and any subscriber having an automatic telephone would dial all numbers, whether automatic or manual. After the first two digits, selecting the office, having been called, the last four digits are displayed on an indicator before a special operator who has means for associating the proper trunk plug with the number wanted, as shown on the indicator. The operator completes the connection by plugging into the multiple. An operator can complete from 550 to 600 busy hour calls.

Fourth: The calling subscriber would proceed as in 3, but the call, instead of being displayed before an operator, would be set up on selector and connector switches. The banks of the connectors would be multiplied with corresponding numbers in the manual multiple. Since the automatic uses positive guarding potential, and the manual negative potential, it is necessary to provide "busy translating" relays. These relays can be installed outside of the connector, so that when the office is later cut to full automatic, these relays can be removed and the connectors will be standard connectors.

In the early stages of the transition, the first or second plans will undobutedly be the cheaper, but, as the conversion proceeds, either the third or the fourth plan has definite advantages. It does not appear that it would be advisable to use call indicator positions unless there are spare "B" positions, with the multiple available, because such positions are expensive and serve no purpose in the ultimate plan. If there is no question of re-location of offices and the space is available in the manual offices, then unquestionably, the proper procedure is to install the selector and connector equipment in the manual offices. In doing this, however, the equipment should be installed in its permanent location so far as possible, in order to avoid the subsequent loss in wasted labor and switchboard cables. There are few existing manual offices in which it is not possible to find the necessary space.

Combine this latter plan with the first plan for calls from manual, and we have the ideal condition from the standpoint of the subscriber, and also from the standpoint of operating cost. If the various "A" operators have dials for completing their calls to automatic, they can also, if sufficient switches are provided for the purpose, dial all numbers to the manual exchanges, in which event, the entire cost of "B" operators will be eliminated. This plan has the further advantage. that the conversion from manual to automatic, in a manual office so equipped, can be made one station at a time.

Unquestionably this method requires a considerably greater investment, but, when it is considered that there is no extensive new investment that must soon be retired, and that the operating savings begin to accrue immediately, it remains only a matter of arranging for the increased initial investment. From the subscriber's standpoint, the automatic subscriber immediately realizes all the advantages of a full automatic system and even the manual subscribers realize the advantage, that, on any call they have only one operator, thus avoiding the many errors and irregularities due to order wire working.

NUMBERING ARRANGEMENT

Regardless of what procedure is followed for handling the mixed service during the transition period, it is necessary at the outset to devise a comprehensive numbering scheme on the basis of ultimate requirements for full automatic. As mentioned before, our considerations are devoted here to the requirements of a very large network requiring a six digit call number with a theoretic capacity of one million subscribers' numbers.

In the operation of a six digit system it is immaterial how the various digits are designated. The designation is largely a question of convenience for the subscriber.

When the call numbers are made up entirely of figures, it is advisable in showing the same in the directory to have the figures blocked either three and three or two and four as 647 529 or 64 7529. This enables a subscriber to fix the number in mind more readily. For such a numbering scheme the dials on the telephones will have only numbers from 1 to 0.

When the call numbers are made up of letters and numbers and one letter is shown opposite each figure on the dial, as for instance $\begin{matrix} A & F & G & K & L & M & U & W & X & Y \\ 1 & 2 & 3 & 4 & 5 & 6 & 7 & 8 & 9 & 0 \end{matrix}$, then the numbers in the directory can be shown as W23 786 or W 23786. In selecting letters there should not be a repetition of letters of similar sound, such as, B, C, D, E, G, P, T, V, and Z or A, H, J, and K, or M and N, Q and U, because it is frequently necessary to repeat a call number over the telephone, and such letters as B, C, D, etc., may become confused with one another or with the figure three; similarly, A, H or 8 may be confused, and the resultant failures or wrong numbers would be a great source of annoyance.

When the call numbers are made up of exchange names and figures, as for instance, North 47529, a name would appear opposite each figure on the dial, as for instance, North, opposite 6. The names chosen for prefixes could have some regional significance which would be applicable to the possible ten offices in each region.

The preceding numbering arrangements, while feasible for a full automatic network, do not lend themselves readily to the mixed system during a transition period.

In the cities of Minneapolis and St. Paul, work is now under way to consolidate the manual and automatic systems in each city. Each city will have a six digit system with mixed service. The calls from manual to automatic will be completed by the "A" operator, by means of a dial, and the calls from automatic to manual will be dialed to call indicator positions in the proper offices. The call numbers are made up of names and figures. Certain letters appear on the dial in conjunction with the numbers, as for instance,

	ABC	DEF	GHI	JKL	MNO	PRS	TUV	XWY	
1	2	3	4	5	6	7	8	9	0

Thus number 64 7529 could be listed in the directory as MIdway 7529 or NIcollet 7529. See Figure 1.

In a case of this kind the subscriber is instructed to dial the first two letters of the exchange name, and then the four significant figures of the number.

With the two groups of three letters corresponding to the first two digits of the call number, it may be possible to form several names but only one is needed. This method of numbering does not differ from that used in the past for manual system, except that, in addition to the name prefix there must always be four significant figures, that is, the smaller numbers from 1 to 99 would be abandoned, and numbers from 100 to 99 would have the fiure "0" prefixed, and Midway 735 would become MIdway 0735. The new office names and the change of numbers to four significant figures can be put into effect before the mixed service is started, and then there would be no further directory change required, and only those subscribers whose telephones would be changed from manual to automatic operation would realize directly that any change in service was taking place. In many cases the existing manual office names can be retained, especially if the trunking scheme as described later provides for calls going direct to the terminating office. The new names chosen should be such, that even those comparatively uninformed, will know what the first two letters of the name are, for instance Hyland would be a poor prefix because many hearing the name might think it to be Highland and thus dial "HI" instead of "HY." Furthermore, such names as North, Highland or Prospect are poor names, because the letters "NO," "HI" and "PR" appear together on the dial and subscribers might easily believe that one movement of the dial, instead of the necessary two, would register both letters.

TRUNKING SCHEMES

Rather than describe in detail the transition in a large network, which would of necessity change for each particular case, I shall endeavor to explain a few points in regard to trunk grouping between offices.

In case only a few trunks are required between two offices under consideration, the trunks are taken directly from the banks of the selectors in one office and through impulse repeaters to the incoming switches in the distant office, and such trunks work in groups of ten or less. However, if the trunking requirements are fairly heavy, it is possible to effect a saving in equipment and conductors by introducing secondary line switches between the banks of the selectors and repeaters. If plunger type outgoing secondary line switches, with ten outlets, are used, theoretic groups up to one hundred can be obtained, while if rotary outgoing secondary line switches, with twenty-five outlets, are used, theoretic groups up to two hundred and fifty can be obtained.

Various studies have been made, to indicate the number of outlets which for any given amount of traffic, will incur the least annual charge. The studies show that the most economical arrangements consists in allowing the searching elements to hunt in a field of twenty-two outlets, and that, if greater efficiency is required, it should be obtained by means of auxiliary apparatus. In other words, if the effectiveness of a large group is desired, it would be more economical to allow the mechanism to search a small field of, say, ten trunks and select a secondary line switch, which in turn takes one of a number of trunks, rather than have a mechanism capable of searching the entire field of trunks, which, it is quite likely, would be considerably more expensive than the present type of equipment.

The busy hour average calls per group for various sized groups with loss 1 in 100 and 1 in 1000 respectively, together with corresponding average occupancy per trunk, are shown in table No. 1.

TABLE NO. 1

Trunks per Group	Busy Hour Aver. Call Loss 1 in 100	Aver. Occupancy per trunk	Busy Hour Aver. Call Loss 1 in 1000	Aver. Occupancy per trunk
10	4.13	0.413	2.96	0.296
20	8.9	0.445	7.03	0.352
25	12.	.48	9.77	0.391
50	28.8	.566	25.15	0.50
75	46.7	.623	41.82	0.557
100	65.1	.651	59.4	0.594
150	102.8	.685	95.5	0.636
200	140.9	.704	132.6	0.663
250	181.	0.724	170.	0.680
500	379.	0.758	365.	0.730

The above table takes into consideration the fact that a large group reached through auxiliary equipment, while least expensive, is not quite as efficient in number of cable pairs, as if the entire field of trunks appeared before each searching mechanism, as for insance, 100 trunks reached through 10 primary and 10 secondary outlets, while they may have a theoretic capacity of 100 trunks, would have the effectiveness of, say, a group of 85.

Assuming a case where 500 trunks would be required if working with a loss of 1 in 100 in one group, then, from the values given in the table, we can readily determine that the following number of trunks would be required if working in group of other sizes as indicated.

TABLE NO. 2

Size Group	Trunks Required Loss 1 in 100	Trunks Required Loss 1 in 1000
500	500	519
250	523	557
100	582	638
50	670	758
25	789	970
20	850	1076
10	917	1285

Consider for the time being a trunk circuit made up of a repeater, a two mile cable circuit, and an incoming selector and take the annual charge of such a circuit at a conservative figure of $27.00. If the trunks are in groups of 500 instead of groups of 250, we see from the table that there would be a saving of 23 trunks, representing an annual saving of $621.00. In order to show a saving, we would have to assume that the equipment for operating in groups of 500 is no more expensive than the equipment for operating in groups of 250. If this is not true, we would not be justified in incurring very much of an additional annual charge before the already small annual saving would be wiped out. On the other hand, the saving of 394 trunks by working in groups of 250 instead of groups of 10 would represent an annual saving of $10,638.00, whereas, working in groups of 250 instead of groups of 100 would save 59 trunks, at an annual charge of $1593.00.

It would be very seldom that more than two hundred trunks would be required to handle the traffic from one 10,000 line office to another of similar size, even with a high community of interest factor. The only time that extremely large groups would come into play might be in trunking from one office having two or three 10,000 line units to another similar office with a very high community of interest factor.

The generally recognized greater efficiency per trunk in large groups tempts one to combine the traffic from one office with that from several other offices and to route it by way of a distributing office rather than direct to each office. This is known as the direct or zone trunking plan, as against the direct trunking plan. One may easily be influenced by the supposed saving in cable pairs without due regard to the increased cost of the trunking equipment.

By way of explanation, let us assume four offices, A, B, C and D, as part of a network, and the distances from A to B as 4 miles and from A to C and D by way of B as 8 miles. We may assume a representative traffic for the busy hour as shown in Table No. 3. See Figure 7. The figures in the last column were derived from Table No. 1 and represent the number of direct trunks required for traffic in one direction between the offices.

TABLE NO. 3

Office From To	Busy Hour Calls	Seconds Holding Time	Call Hours	Trunks Required
A—B	3364	110	102.8	150
A—C	1528	110	46.7	75
A—D	360	120	12.	25
B—C	2130	110	65.1	100
B—D	860	120	28.8	50

Table No. 4 shows the traffic from "A" to "B," "C" and "D," combined and carried to B, where the traffic from B to C and D joins the traffic from A for the respective offices, as would be done in a district scheme. See Figure 8.

TABLE NO. 4

Office From To	Busy Hour Calls	Seconds Holding Time	Call Hours	Trunks Required
A—BCD	5252	110	160.2	223
AB—C	3658	110	111.8	162
AB—D	1220	120	40.7	68

It should be noted that each inter-office trunk circuit consists of an impulse repeater at the outgoing end in one office connected by means of a cable pair to an incoming selector at the other end. For the purpose of comparison we may take the annual charges on the equipment associated with an inter-office trunk as $15.00, a conservative figure, and the annual charges on the cable pair as $6.00 per pair mile. On this basis the figures for the direct trunking plan are shown in Table No. 5 and for the district plan in Table No. 6.

TABLE NO. 5

Office From To	Trunks Required	Pair Miles	Annual Charge Equipment	Annual Charge Cable	Annual Charge Total
A—B	150	600	$2250.00	$3600.00	$5850.00
A—C	75	600	1125.00	3600.00	4725.00
A—D	25	200	375.00	1200.00	1575.00
B—C	100	400	1500.00	2400.00	3900.00
	50	200	750.00	1200.00	1950.00
	400	2000	$6000.00	$12000.00	$18000.00

TABLE NO. 6

Office From To	Trunks Required	Pair Miles	Annual Charge Equipment	Annual Charge Cable	Annual Charge Total
A—BCD	223	892	$3345.00	$5352.00	$8697.00
AB—C	162	648	2430.00	3888.00	6318.00
AB—D	68	272	1020.00	1632.00	2652.00
	453	1812	$6795.00	$10872.00	$17667.00

For this particular case it appears that there is no real economy in the district plan. While this may be true, in general, still there are cases where the district plan may be the more economical, especially where the distance from an office to the district or distributing office is great.

Aside from the question of cost just considered, the direct trunking plan has certain advantages in a six digit mixed system which may be briefly summarized as follows:

First: The district plan necessitates that the first digit for all offices in the district be the same, and accordingly, the choice of office names is restricted. This is not necessary with the direct trunking plan.

Second: In the direct trunking plan, each automatic office has the same elements of equipment, and it is comparatively simple to make the layout for the ultimate period, whereas with the district plan, the ultimate for the entire district must be considered in making the layout for the distributing office. It may happen that a manual office would be the logical distributing center, whereas other considerations mikht make it advisable to defer the conversion of the particular manual office involved.

Third: Under the district plan calls from office A to C go through outgoing trunk repeaters at A and at B which renders more difficult and complicated the location of unstandard conditions, whtn such occur.

The transition can be divided into several periods more or less over-lapping, as follows:

First Period:

Automatic to Manual: Automatic subscribers are instructed to dial a pre-determined digit, say, "9," or two digits, "MA" (62), for calls to manual. The calls would be trunked to the nearest manual office where they would be completed in the regular manner. See Figures 9 and 10.

Manual to Automatic: The manual "A" operator would transfer the call by order wire to a simple dial sending position. See Figure 11.

Second Period:

Automatic to Manual: After determining the ultimate numbering scheme and changing the manual office names to correspond with their ultimate automatic names, the automatic subscribers may be instructed to dial the first two letters of the office wanted, and then give the number to the operator. See Figure 10.

Manual to Automatic: The "A" operator handles the call the same as during the first period, but the sending positions may be equipped with key senders instead of dials, to increase the operating efficiency. See Figure 11.

Third Period:

Automatic to Manual: The automatic subscriber may be instructed to dial all numbers as listed in the directory, with the first two letters of the office name and the four significant figures of the number. In the manual office the call will be set up on an indicator before an operator or on final switches connected with the manual multiple. It may occur that one or two manual offices may be scheduled for conversion in a short time, and that the call indicators would not prove in for such a short period, while on the other hand it may not be advisable to install final switches because the office location is to be changed. In this case the full number may still be dialed, but the operator would intervene, as during the second period, and complete the connection. See Figures 10, 12 or 13.

Manual to Automatic: Such manual offices as will not be converted until near the end of the transition period, may have the "A" operators' positions equipped with dials, and calls to the automatic offices and to the manual offices equipped with final switches may be completed by the "A" operator, by means of the dial. See Figure 14.

Fourth Period:

The remaining manual offices may be converted, and everything handled on a full automatic basis. See Figure 15.

Conclusion:

While this discussion has been on the basis of a six digit network, the principles will apply equally for a seven digit system wherein the subscriber would dial the first three letters of the office name and the four significant figures of the number. A seven digit network would likely be divided into several zones, as determined by the first digit. Within each zone the trunking would likely follow the direct trunking plan.

So far, no insurmountable obstacles have been encountered in any transition projects undertaken, which does not mean, of course, that there are not likely to be many new and intricate details to be settled in connection with each undertaking.

With the present development of the art, it is possible by means of automatic switching equipment, to give telephone service to meet the most exacting requirements, and we may expect to see such equipment universally applied.

Economic Lines of Gravitation for Overseas Movement From the Mississippi Basin

SHOULD COMMERCE FOLLOW OR DICTATE TRANSPORTATION?

BY JAMES ROWLAND BIBBINS*

Presented Sept. 30, 1920.

Joint Meeting—Western Society of Engineers and American Association of Port Authorities.

INTRODUCTORY

THE following discussion of some of the broader fundamentals of transportation is believed to be of interest to the American Association of Port Authorities, and particularly to the Midwest Convention in Chicago, because the subject has a most important bearing upon the collateral subjects of trade routes, inland traffic gateways and port terminals. These should concern port authorities quite as much as the details of port planning, at least during the development stages when great programs of port expenditures are laid down for future execution. It is for this reason that the Terminal Committee of the Western Society has endeavored to contribute to the Chicago program a symposium devoted to rational and efficient port-terminal development, which the committee regards as of signal importance, and it is hoped that the Association will, in examining the Chicago District, strengthen the convictions held by many students of the problem, that the relationship between inland and seaboard ports, and the intervening trade trunks, rail and water, is one of the major elements.

GENERAL SURVEY—THE MISSISSIPPI BASIN

The United States covers an area of about 3,000,000 square miles, nearly half of which is in farm lands and may be said to be in active production. The Mississippi Basin or watershed covers about 1,725,000 square miles, including over two-thirds of the farm acreage and half of the nation's population. It produces over three-quarters of the grain, live stock and wool, over two-thirds of the oil, cotton and bituminous coal and nearly all of the iron ore. In manufactures it produces nearly half of the nation's output.

The centre of gravity of production resides probably in Illinois, around latitude 40° or the same parallel which bisects the Mediterranean and the Sea of Japan.

Foreign consumption calls for about 25% of the total domestic production of the States, or perhaps the same proportion from the Mississippi Basin. This production is now destined for the most part, north of the Tropic of Cancer (passing just north of Cuba and Hawaii). But the South Seas are rapidly drawing from the North, often resulting in the famous "trade triangle" so much prized as an antidote for empty bottoms homeward bound.

THE VALLEY A VAST NATURAL DRAINAGE BASIN

Consider the Mississippi Basin in the light of economic topography—a great producing and exporting region stretching between the Rockies on the west and the Appalachian chain on the east. How

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*Supervising Engineer, The Arnold Company; Member of Society of Terminal Engineers; Chairman, Terminal Committee, Western Society of Engineers.

does this vast tonnage move to port out of this area? How *should* it move? Here is a specific analogy to man-made transportation—(a) a network of railway feeders merging into (b) the major trunk lines, these finally traversing (c) the traffic gateways and inland terminals, or else (d) reaching sea ports. The single exception to the analogy is when the railroad trunks climb the mountain divides on their journey eastward or detour around the foot hills. Like water, commerce chooses the easiest path to destination and would keep moving if not hindered in transit. When retarded it floods or destroys. Like the great network of brooks and streams, this never ceasing tide follows first the minor water courses, until it merges with others in major streams, and then in broad rivers to the sea. All would be well if we could keep this tonnage moving. The trouble comes in arresting it in various impounding reservoirs, i. e., terminal and classification yards, the mechanism of which, both human and mechanical, is so delicate as to break down quickly if anything goes wrong. Then the dikes and levees are ruptured and through the dreaded embargo the flow backs up, sometimes for hundreds of miles.

THE PREDOMINANCE OF EAST-WEST MOVEMENT

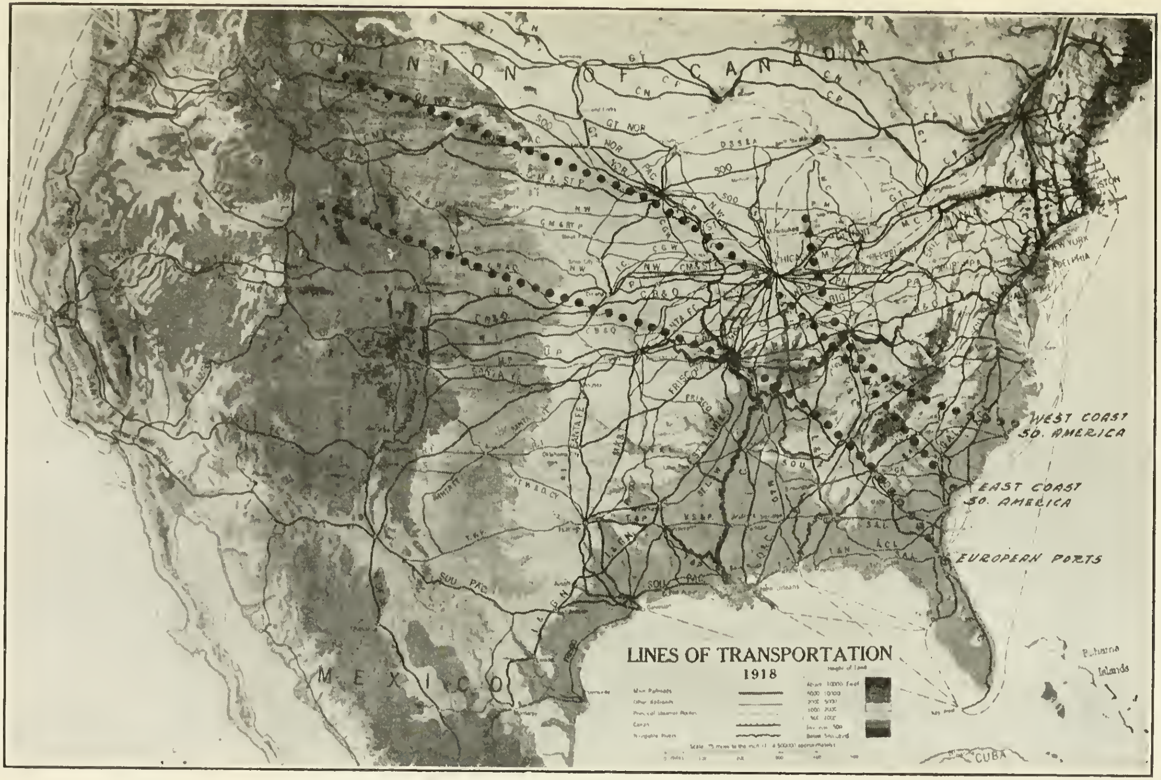
Examine the transportation systems of this great economic drainage basin. (See accompanying map.) The railroads clearly tell the story of a preponderant movement east-west over the Appalachian Range. This movement developed naturally under the urge of European demand. In fact, the whole rate structure is and has been erected upon this Chicago-Seaboard *mountain-grade* base line—not upon the natural *water-grade* base line of Chicago to the Gulf—90° around the circle.

Is it not unfortunate that there are relatively so few major traffic gateways—Chicago, St. Louis, Cleveland, Cincinnati, Pittsburg, Buffalo, and that these are located within the great centres of congestion, and not outside, where they should be, theoretically. For through or trans-shipped traffic has no business to clutter up our city facilities so badly needed for local business. (Thus 60% of Chicago's L.C.L. tonnage and about half of the total loaded car movement is through transfer.)

Obviously port and marine competition have had their influence in this preponderant rail development, in fact, so much so that not one major railroad trunk runs from New Orleans, the major southern water-gate, direct into the great northwest producing lands of Oklahoma, Kansas and Nebraska. This seems vastly significant of unwholesome tendencies, past, present and future, and it will probably not be corrected until transportation is conceived as a whole on broad lines and the nation begins to think in world-wide terms rather than in the purely empirical terms of established local precedent.

ECONOMIC FEATURES INVOLVED—MAINLY TIME AND COST

What determines transportation routes within a great natural producing area like the Mississippi Basin? 1st, carrier lines, both feeder and trunks in strategic locations; 2nd, mobile equipment in abundance, especially for seasonal movement; 3rd, efficient terminal and transhipment machinery at the gateways; 4th, warehousing facilities ample and suited to the commodity, to reduce car holding; 5th,



ECONOMIC MEDIAN LINES FOR OVERSEAS TRANSIT
SHOWING DIVISION OF TRIBUTARY TERRITORY BETWEEN NEW ORLEANS AND NEW YORK
Based on average prevailing tariffs, assuming the cost of one mile of rail haul equals cost of four miles of water haul.
Map reproduced by courtesy of the Public Belt Railroad Commission of the City of New Orleans, being Exhibit 1 of the Report of the Board of Advisory Engineers to the Bridge or Tunnel Committee of the above Commission.
(Base Railroad Contour Map of United States, reproduced by courtesy of Denoyer-Geppert Co., Chicago.

efficient ports and port terminals to facilitate low transhipment costs and rapid "turn around" for vessels in port; 6th, frequent and definite marine sailings, requiring well "balanced" port traffic, in and out; 7th, and most important, comparative rates and charges rail-water, terminal, port, and overseas. Thus the elements of *time* and *cost* ultimately control most competitive movements and it becomes pertinent (or perhaps impertinent), to ask:

Does traffic gravitate along natural rational lines? The answer may best be demonstrated graphically by the accompanying exhibit, presented through the courtesy of the Public Belt R. R. Commission of New Orleans, being a part of a technical study of the transportation development of the port of New Orleans.*

ECONOMIC MEDIAN LINES SHOW LOGICAL TRIBUTARY REGIONS

This exhibit shows what territory is properly tributary to the Gulf and to the North Atlantic ports respectively, disregarding all other considerations except those of the *cost-distance* of rail and overseas transportation, which is the only definite comparable basis for such an economic analysis now available, unless many intangible variable quantities are introduced. In other words, the cost-of-service basis of average rail haul per ton-mile in the United States and average water haul overseas, as reflected in the actual transportation charges or shipping rates, is the basis used. To illustrate typical trade routes, the controlling rate points or traffic gateways, Gibraltar, Pernambuco and Panama, are taken to represent the conditions applicable generally to European ports, South American East Coast ports and Pacific ports respectively. A simple and comparatively accurate assumption is made that the cost of one mile rail haul equals that of four miles water haul, thus eliminating a vast number of variables in rates and commodities. While the exhibit reflects "pre-war" rates, it would equally reflect higher or lower rate levels as between rail and water if the changes maintained the same proportion.

Now, these three median lines indicate that the territory east of each line should logically ship goods overseas through the North Atlantic ports; the territory west of each line should ship and receive goods through the Gulf ports. Considering Panama as the water gate to the Pacific and West Coast of South America, it will be seen that almost the entire Mississippi Basin is logically tributary to Gulf ports. For the East Coast of South America, the Chicago gateway marks in general the dividing line between Gulf and Atlantic ports. And for European points it appears that almost half of the Mississippi Valley should in fact be tributary to Gulf ports.

This exhibit reflects only *all-rail hauls.* Yet the present intensive consideration given to the Mississippi and St. Lawrence projects raises the collateral question—what effect would the rational use of waterway trunks have upon these respective medians and tributary areas? Considering South American East Coast shipments, such as Brazilian coffee, it seems quite evident that the Gulf route to Chicago would be preferable, perhaps as far east as Cleveland, while for the Mediterranean trade, the Gulf and St. Lawrence routes might possibly balance, due to the shorter mileage of the Mississippi water route, as compared with the St. Lawrence high latitude. For Pacific trade, the Gulf route would be very distinctly more favorable. Obviously the proposition is full of interest and calls for a careful comparative study.

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*By the Board of Advisory Engineers, Bion J. Arnold, Chairman, J. A. L. Waddell and Vipond Davies.

JOINT RAIL-WATER ROUTES

Further refinement of such an economic study would probably take into account *joint rail-and-water* routes within the United States, from which study tributary territories could rationally be assigned as in the preceding cases, and with equal definiteness.

That such a comparison of natural transportation routes is not theoretical in any sense is evidenced by the fact that joint rail-water routes are today in force from Wheeling to Omaha and from Canada to the Gulf, using the Mississippi from St. Louis and Cairo going south as *a great water trunk,* just as it should be. The joint rate principle is now mandatory in the United States, through the Panama Canal Act.

PORT TERMINAL DIFFERENTIALS—TIME AND COST

The second and a vastly important variable is that of terminal transhipment cost and dispatch. And it would be of interest to work out a new set of median lines as between Atlantic and Gulf ports, taking into account the tremendous cost and delays now encountered in the congested port of New York, where it is said to cost $35.00 per car to move goods from Jersey Meadows to New York waterside. It is of course understood that numerous items are involved, differing as between ports in charges for piloting, towage, port charges, wharfage, stevedoring, etc. The study presented herein simply assumes normal "pre-war" port-terminal conditions with transhipment charges absorbed in either the line or the water haul, and with the normal differentials as between ports.

A careful comparative analysis (by Messrs. Ford, Bacon & Davis) of a hypothetical ship and cargo passing through port indicated a fairly equal total charge as between New York and New Orleans in normal times. But this, however, does not reflect in any degree the result of local port congestion such as is now being experienced, and which might easily introduce elements of excess cost, dwarfing the cost of the entire water haul.

TERMINALS—THE KEY TO THE SITUATION

The transport situation at the present time might be characterized by reference to "Faith, Hope" and Terminals. Purposely the author has left to other speakers a discussion of terminal planning for lake ports. In particular, the Port of Chicago is a clearly defined problem in itself, for it involves four different services, viz., passenger, rail to lake, barge to lake, barge to rail, both L.C.L. and carload, and it is no easy matter to confine the solution all in a given location. In Chicago probably over 125,000,000 tons per year moves by rail in and out, half of it through interchange; but relatively little moves over the wharves—a rail-terminal problem at present. In New Orleans nearly one-third of the incoming freight passes over the wharves direct; probably well over one-half, if all freight held "in transit" were included. Only 13% is through rail interchange. This is evidently an important port-terminal problem. In Milwaukee, the lake tonnage is creeping up to nearly as much as the rail tonnage. If the same proportion occurred here, Chicago's new harbor district No. 3 would be a busy place indeed, even though it could contain almost the entire free port of Hamburg within its north and south boundaries. Thus the inactivity of the Port of Chicago might suddenly be supplanted by extraordinary development when the importance of internal water routes as a supplementary transportation agency is fully appreciated and terminal development proceeds therewith.

THE ECONOMIC SURVEY

There is only one open road, in the author's opinion, to a sane and correct solution of terminal design—facts rather than conjectures or opinion—i. e., a complete survey of (a) the physical plant, (b) its operating plan—capacity and cost, (c) the actual movement of traffic through the terminal machine. Traffic officials will often deny the feasibility of such a survey. *But it can be done.* In the author's experience, at least one survey has been made showing for the entire metropolitan port district the following:

1. *Origin and Destination* of all car movements: By wharves—export and import; by industries—direct delivery, via switching lines; by carriers facilities—freight and warehouses and team tracks; by interchange—through via intermediate lines; by territorial carrier groups.
2. Cars held in terminal at various times.
3. Seasonal variation in all movements.
4. Movements of empties—logical and illogical.
5. Point and volume of interchange. Useful and excess movements. Number of intermediate lines used.
6. Centres of gravity of tonnage handled with respect to port business, warehouse business, local city business.

In short the survey indicated:

1. The relative efficiency of present terminal organization and improvements desirable.
2. Relative correctness of yard and interchange location and the general lines of future reorganization and development—hump yards, clearing, etc.
3. Proper development of the City Plan.
4. Proper location of Belt Line facilities so necessary in any port and railroad centre.
5. Desirable form of administration, finance and accounting.
6. Best methods of co-ordinating rail-barge and marine operations to the maximum benefit of the city and its tributary commerce.

CONCLUSION

From this discussion it is clear that many factors, local, national and even international, are at work to distort *rational* commodity movement. Perhaps such an ideal will never be attainable in a democratic country until public opinion comes to be guided broadly by national rather than local interests. This applies to railroad, terminal and port building and their administration as well, in the interest of maximum collective efficiency. The main thought, in closing, is that our internal cross-roads, our rail and water *gateways* need more attention and co-ordination. We need trunks, but also efficient transhipping and distributing machinery, such as neutral belt lines, universal freight stations, water-rail clearing facilities and low handling costs. The magnitude of the problem is staggering but *nothing is impossible in America,* with one proviso—*united action.* For the Port of Chicago, the greatest railroad centre on earth, the first question is: *What kind of a machine is required to enable it to fulfil its manifest destiny?*

SOME FACTS ABOUT THE PORT OF CHICAGO

1. Chicago the cross-roads of water transit.
2. Port authorities in control: State—3. City Boards and Commissions—2.
3. Chicago port frontage, 67 miles; total improved frontage, 14 miles. Number of bridges, 52.
4. Chicago river frontage, 43 miles with branches.
5. Number of railroads in Chicago—40. Major systems—26, belt and switching lines—10.
6. Railroads own river frontage—25,000 ft.
7. City owns about one-eighth of the improved frontage.
8. R. R.'s using water terminals—8.
9. S. S. lines using wharfage—20.
10. Lighterage companies—2.
11. Coal companies, waterside—11. Coal wharves—24.
12. Calumet River (South Chicago) to fork—88,000 ft.; developed—57,000 ft.
13. Gross tonnage of Great Lakes Fleet at beginning of the War (over 1000 tons)—2,489,173. Number of vessels (over 1000 tons)—644. Exceeded total tonnage of sea-going fleet under American Registry—(over 1000 tons).
14. *Illinois,* the approximate centre of U. S. population, farming and land values, value of crops, corn belt, central bituminous coalfields.
15. Majority of seaboard ports are on rivers 50-100 miles inland.

“Errata”

EVOLUTION OF BRIDGE DESIGN

by Charles Evan Fowler

JOURNAL WESTERN SOCIETY OF ENGINEERS

Vol. XXV., No. 15.

Page 574,	Line	20,	Read	“endeavor to interest”
575,	“	7,	“	“Euler”
	“	9,	“	“and other early”
	“	15,	“	“many wooden bridges”
576,	“	12,	“	“Euler”
	“	15,	“	“Euler”
	“	24,	“	“by Hodgkinson”
577,	“	8,	“	“my first chief”
	“	29,	“	“Bouscaren”
	“	38,	“	“Greiner”
578,	“	24,	“	“$12000\ (1+\frac{\text{Min. Stress}}{\text{Max. Stress}})$”
	“	27,	“	“Morison”—“Rulo”
	“	40,	“	“on mechanics”
580,	“	21,	“	“little new”
581,	“	9,	“	“silicon”
	“	10,	“	“chrome vanadium”
	“	41,	“	“+50,000”
582,	“	3,	“	“and E-75”
586,	Item	1,	“	“150×D. L. Stress’
	“	4,	“	“to 0% for”
587,	“	1,	“	“Chords” (omit “equals”)
	“	9,	“	“$\frac{l^2}{100}$”
588,	“	5,	“	“Spans over 200 ft., chords, etc.”
	“	13,	“	“Tension 16,000 lbs. sq. in.”
589,	“	1,	“	“$p=\frac{8000}{1+\frac{l^2}{20,000\ r^2}}$”
	“	3,	“	“$p=\frac{18,000}{1+\frac{l^2}{10,000\ r^2}}$”

Page 589, Item 4, Read "$p=\dfrac{18{,}000}{1+\dfrac{l^2}{18{,}000\ r^2}}$"

" 6, " "$p=\dfrac{6500\left(1+\dfrac{\text{Min. Stress}}{\text{Max. Stress}}\right)}{1+\dfrac{l^2}{18{,}000\ r^2}}$"

" 7 " "$p=\dfrac{7800}{1+\dfrac{l^2}{30{,}000\ r^2}}$"

" 8 " "$p=\dfrac{9000}{1+\dfrac{l^2}{18{,}000\ r^2}}$"

" 9 " "$p=11{,}000-570\dfrac{l}{r}$ (l=feet)"

590 " 2, " "for L read h"

" 4, " "$p=\dfrac{17.000}{1+\dfrac{l^2}{11{,}000\ r^2}}$"

" 5, " "$\left\{\begin{array}{lll} \text{Steel Chords} & \text{L. L.}= & 10{,}000-45\dfrac{l}{r} \\ & \text{D. L.}= & 20{,}000-90\dfrac{l}{r} \\ \text{Posts} & \text{L. L.}= & 8{,}500-45\dfrac{l}{r} \\ & \text{D. L.}= & 17{,}000-90\dfrac{l}{r} \end{array}\right\}$"

" 6, " "$\begin{array}{l} p=16{,}000-70\dfrac{l}{r} \\ p=15{,}000-50\dfrac{l}{r} \end{array}$"

Line 8, " "however, can be"

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v.25

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Engineers, Chicago
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